BUS. ADM. LIBRARY
3 - DAY LOAN
THE UNIVERSITY OF MICHIGAN
SEP 19 1960
BUSINESS ADMINISTRATION LIBRARY
HB
1
.095
M.S.
V.12
no.2

OXFORD ECONOMIC PAPERS

(NEW SERIES)

VOLUME 12 JUNE 1960 NUMBER 2

Editorial Board: N. H. LEYLAND (*General Editor*), J. R. HICKS, C. M. KENNEDY, SIR DONALD MACDOUGALL, G. B. RICHARDSON, P. P. STREETEN (*Secretary*)

CONTENTS

Thoughts on the Theory of Capital—The Corfu Conference. By J. R. HICKS 123

Returns to Scale. By M. H. PESTON 133

Israel: Ten Years of Economic Dependence. By S. RIEMER . . 141

The Working of the Radcliffe Monetary System. By A. E. JASAY . 170

Equity and a Capital Gains Tax. By R. TURVEY 181

A Static Interpretation of some Recent Theories of Growth and Distribution. By CHARLES KENNEDY 193

Industrialization in Overpopulated Areas, A Geometric Interpretation of Certain Aspects. By F. SETON 202

Cyclical Fluctuations and Economic Growth. By LUIGI L. PASINETTI 215

OXFORD
AT THE CLARENDON PRESS
1960

OXFORD ECONOMIC PAPERS

(NEW SERIES)

OXFORD ECONOMIC PAPERS, of which eight numbers appeared at irregular intervals between 1938 and 1947, became a periodical in 1949 and is now published three times a year. The pre-paid subscription price is 35*s*., post free, and the price of a single copy 16*s*. net. Orders may be placed with any bookseller or sent direct to the Publisher.

PAPERS should be sent to the General Editor, c/o The Clarendon Press, Oxford. Contributors receive 50 free offprints. All correspondence other than that dealing with contributions should be addressed to the publishers:

OXFORD UNIVERSITY PRESS
AMEN HOUSE, LONDON, E.C. 4

THE ECONOMIC JOURNAL

No. 278 **JUNE 1960** **Vol. LXX**

I. *Articles*

A Survey of Welfare Economics, 1939–1959	E. J. MISHAN
The Age of Economic Development	E. R. BLACK
Second Essay in Dynamic Theory	SIR ROY HARROD
The Social Anthropology of Economic Underdevelopment	J. L. SADIE
The Forward Pound 1951–59	B. READING
Real Balances, Expectations and Employment	K. K. KURIHARA
Marginal Productivity and Probability Distributions of Factor Services	A. A. WALTERS
Income Distribution in the Edgeworth Box Diagram	M. H. PESTON
A Model for the Study of Protected Oligopolies	S. STYKOLT and H. C. EASTMAN
The Withdrawal of Railway Services	M. HOWE and G. MILLS
International Reserves and Liquidity	T. BALOGH

II. *Reviews*

III. *Notes and Memoranda*

IV. *Recent Periodicals and New Books*

MACMILLAN & CO., LTD., LONDON, W.C.2

Application for Fellowship to

ROYAL ECONOMIC SOCIETY, 21 Bentinck Street, London, W. 1

BUS. ADM. LIBRARY
HB
1
.095
n. s.
v. 12
no. 2

FOOD, LAND, AND MANPOWER IN WESTERN EUROPE

P. LAMARTINE YATES

The contribution that the farm economy of Western Europe could make to general economic expansion is the central theme of this new study of the region's food supply and agricultural problems. European agriculture has excess manpower; it could produce as much food or more with half its present labour force. How this maladjustment has come about and how governments might recast their agricultural policies to meet the new situation is discussed by Mr. Lamartine Yates, the well-known writer on Europe's farm economy. 35*s*

MACMILLAN & CO LTD

ST MARTIN'S STREET LONDON WC2

C. W. GUILLEBAUD

The Wages Councils System in Great Britain

'Explains clearly how and why the system began, the powers and functions of councils and the way in which they work in practice.' *The Times.*
32 pp. 2*s.* 6*d.* net

Wage Determination and Wages Policy

In this (second) Economic Monograph, Mr. C. W. Guillebaud discusses the economic factors which affect a wages policy, and considers the present policy in detail. 32 pp. 2*s.* 6*d.* net

James Nisbet & Co. Ltd., Welwyn

SCIENCE & SOCIETY

Established 1936

VOL. XXIV, No. 2 SPRING 1960

The Seventeenth Century in the Development of Capitalism — *E. J. Hobsbawm*
Mills and Weber — *G. B. Sharp*
Monopoly Capitalism and Marx's Economic Doctrine — *Alfred Evenitsky*
Opinions on Darwin a Century After — *Harry Grundfest*
Existentialism in Psychology — *Edwin Berry Burgum*
On Unproductive Employment — *Justin Blake* and *Jacob Morris*

Book Reviews by *Howard Selsam* on 'John Dewey'; *Richard Greenleaf* on 'Mark Twain'; *Norman Cazden* on 'Mozart and His Music'; *A. W. Coats* on 'Founders of American Economic Thought'; *I. Black* on 'Rutherford B. Hayes and the Slater Fund'.

Quarterly, 75 cents single copy — $3.00 per year ($3.50 foreign)

SCIENCE & SOCIETY, 30 EAST 20TH STREET, NEW YORK 3, N.Y.

SOCIAL AND ECONOMIC STUDIES

A Journal devoted to research, especially in the problems of economic growth, social change, and political action in underdeveloped territories

Among recent papers and publications are the following:

The Economy of St. Kitts-Nevis-Anguilla — Carleen O'Loughlin
Symposium on the Report of the Trade and Tariffs Commission — H. G. Johnson, W. G. Demas, G. M. Meier, T. Balogh
Revisions and Suggestions for Deflating Gross Product Estimates — Alfred P. Thorne
Accelerated Development with a Minimum of Foreign Aid and Economic Controls — R. W. Lindholm
The Beneficial Effects of Devaluation in Some Underdeveloped Economies — Alexander Rubner
Economic Development: A New Strategy — Lloyd Best
A National Accounts Study of the Economy of Barbados — Jeanette Bethel

Annual subscription per volume £1. 10*s.* 0*d.*; U.S., $4.25; W.I., $7.20.

INSTITUTE OF SOCIAL AND ECONOMIC RESEARCH

University College of the West Indies, Jamaica, W.I.

9-23-60

ECONOMICA

Published Quarterly

ECONOMICA is published quarterly by the London School of Economics and Political Science, in February, May, August, and November, and is devoted to research in the fields of Economics, Economic History, and Statistics. The Journal is under the direction of an editorial board composed of Professor R. G. D. Allen, Professor W. T. Baxter, Professor E. H. Phelps Brown, Sir Sydney Caine, Professor E. Devons, Professor R. S. Edwards, Professor F. J. Fisher, Professor F. W. Paish, Professor A. W. Phillips, Professor Sir Arnold Plant, Lord Robbins, Professor R. S. Sayers, with Professor B. S. Yamey as Acting Editor.

New Series, Volume XXVII CONTENTS No. 106. May 1960

Bilateral Monopoly, Successive Monopoly, and Vertical Integration — *Fritz Machlup* and *Martha Taber*
Towards a More General Theory of Capital — *C. A. Blyth*
Some Effects of the $1.00 Minimum Wage in the United States — *H. M. Douty*
Economists' Cost Rules and Equilibrium Theory — *G. F. Thirlby*
Methodological Prescriptions in Economics: A Reply — *T. W. Hutchison*
A Rejoinder — *K. Klappholz* and *J. Agass*
The New Age of Technology, 1750–1900 — *D. C. Coleman*

The price of ECONOMICA (New Series) is 10*s.* 0*d.* a number, or £1. 10*s.* per annum, post free. Copies may be obtained on order from the Publications Department of the London School of Economics, Houghton Street, Aldwych, London, W.C. 2, to which address all subscriptions and business communications should be sent.

SCOTTISH JOURNAL OF POLITICAL ECONOMY

(The Journal of the Scottish Economic Society)

VOL. VII JUNE 1960 No. 2

The Economic Articles in Blackwood's Edinburgh Magazine, and their Authors, 1817–53 — F. W. FETTER
Adam Smith, Clubman — J. F. BELL
Recent Developments in the Jute Industry — A. V. COLE and A. M. CARSTAIRS
Industrial Planning in Hungary — G. F. RAY
The Restrictive Trade Practices Act, 1956: A Review of Certain Judgments — F. LIVESEY
Current Topics

The SCOTTISH JOURNAL OF POLITICAL ECONOMY is published in February, June, and October, and is free to members of the Scottish Economic Society. Applications for membership should be made to the Treasurer, Scottish Economic Society, 142 St. Vincent Street, Glasgow, C. 2, enclosing the annual subscription of £1. 5*s.* 0*d.* The Journal may also be obtained by non-members of the Society by ordering through any bookseller or direct from the Publisher, Oliver & Boyd, Tweeddale Court, Edinburgh, price 10*s.* per single copy.

The Economics of Shipbuilding in the United Kingdom

J. R. PARKINSON

An account of the present state of the British shipbuilding industry, its future prospects and how it stands in relation to its competitors. PUBLICATIONS OF THE DEPARTMENT OF SOCIAL AND ECONOMIC RESEARCH, UNIVERSITY OF GLASGOW. 40*s. net*

Productivity and Technical Change

W. E. G. SALTER

A comprehensive discussion of the relationships between productivity and technical change, combining a theoretical analysis with an empirical survey of productivity in a number of British and American industries. 26 *text-figures*, 40 *tables*. CAMBRIDGE DEPARTMENT OF APPLIED ECONOMICS MONOGRAPHS.
22*s.* 6*d. net*

Production of Commodities by means of Commodities

PIERO SRAFFA

Mr Sraffa studies the effects that changes in distribution between profits and wages may have on the values of individual commodities. This is a specialist work addressed to those interested in pure economic theory. 12*s.* 6*d. net*

Concentration in British Industry

R. W. EVELY AND I. M. D. LITTLE

A study of the extent to which British industries are dominated by large firms, and the changes in this concentration during the past twenty years. Some 200 industries are covered and there are brief case-studies of twenty of them. Published for the National Institute of Economic and Social Research. 55*s. net*

CAMBRIDGE UNIVERSITY PRESS

THOUGHTS ON THE THEORY OF CAPITAL—THE CORFU CONFERENCE

By J. R. HICKS

In September 1958 the International Economic Association held a conference on the theory of capital at Corfu. Though it was only a small conference, there were present quite a number of those economists who have actively contributed to this controversial subject within recent years. We did not have Harrod, or Joan Robinson, or Trevor Swan; but we did have Samuelson, Kaldor, Domar, Solow, Champernowne, Fellner, Lutz, and Malinvaud—as well as the statisticians Goldsmith, Barna, and Hoffman. The contributions that have been made to the subject by Erik Lindahl, the then president of the association, are not recent, though they have been durable; his presence must be noted, though he did not take a large part in the conference—it was the last time that many of us were to see him.

The *Proceedings* of the conference will be published, so that what was done will stand on record. I have, however, been moved to write the present paper, since I think that something comes (or should come) out of a meeting like that, which *Proceedings* will not quite give. The papers which will appear in that volume were (with one notable exception[1]) written before the conference; though the openers of the discussions had had an opportunity to reflect upon the papers, later participants could not have an opportunity to reflect on the discussions, so that much which was said was bound to be of the nature of a first impression. Any general clarification which emerged from the discussions could not really come out. Others, like myself, no doubt came away feeling that we should really make progress if, after a decent interval, we could begin all over again. Such a discussion ought to lead to further discussions; but it may do no harm if the further discussion is at long range. And it may be that a good way of beginning it would be for several of us to set down what, from our points of view, seems to be the stage that has been reached.

That, at least, is what I shall try to do, from my own point of view, in the following pages.

I

Why, one may begin by asking, is there just now all this interest in capital theory? Partly, no doubt, it is an outcome of the general interest in problems of growth—development and underdevelopment; this is to

[1] Kaldor's paper, as it is to appear, was not given at the conference; it has not been fully taken into account, in its final form, in the subsequent pages.

be explained by practical problems thrown up in our own time. But quite apart from that practical stimulus there are theoretical reasons. The working of a process of capital accumulation has always been a major interest of economists; it is even one of the main threads in the *Wealth of Nations*; but though what the classics had to say about it is not to be sneezed at, it is a matter on which the great economists of the neo-classical, or marginalist, epoch had been quite conspicuously unsuccessful. Marshall was so ashamed of his own contribution that the chapters which had appeared in the first edition of the *Principles* as Part VII—a place of honour as the crown of the work—are relegated in later editions to an inconspicuous place at the end of Part VI, which appears to deal with quite different matters. J. B. Clark stopped at the edge of 'Dynamics' and so did Wicksell. The subject which is now causing us so much trouble is precisely that which baffled the giants of that time.

It is of course true that 'Dynamics' can include not only the study of long-period growth, but also that of short-period equilibria, such as was made by Keynes. As a result of Keynes's work, and those of his contemporaries in the twenties and thirties, short-period dynamics is largely cleared up. But the successes that have been won at that end have only thrown into greater prominence the gaps at the other. In a sense it may be said that the long-run theory has been made harder than it was, because it has not only got to make sense in itself, and to fit the facts in itself; it has also got to square with what we know, or think we know, about the short period. That, as it turns out, is quite a nasty requirement.

For one of the first things that happen when we apply the simplest Keynesian ideas to the long period is that even the scraps of knowledge that we thought we had seem to go west. Keynes undermines the classical long-period theory, just as he undermined the classical short-period theory. It may be worth while to set out in simple terms how this is, for it has not always been made so very clear.

The one general feature that persists through all pre-Keynesian economics—through Smith, Ricardo, Mill, Marshall, Wicksell—is something like this. At any particular time, with given capital stock, given supply of labour, and given technical knowledge, there will be certain opportunities for productive investment—certain ways in which aggregate output can be increased by the investment of capital. If net saving is being made, some of these opportunities can be utilized in the current period; the rate of interest or profit (we need not bother in this context to distinguish) will be equal to the yield on the marginal investment that can be made with these current savings. In the next period (if there is no increase in the supply of labour, and no new technical knowledge) it will be necessary to have recourse to investments with lower yields; accordingly, if

positive saving is still forthcoming, the rate of interest will fall. This process will continue, in the absence of new ideas, until the rate of interest has fallen so low that it checks saving. Then the process of accumulation stops, and the economy is in a *stationary state*.

This is the classical conception, which I shall use as a starting-point, though freely admitting that it is open to criticism from several angles. For convenience of reference we may put it on a diagram (Fig. 1). The rate of interest (r) is measured on one axis; the stock of capital (K) along the

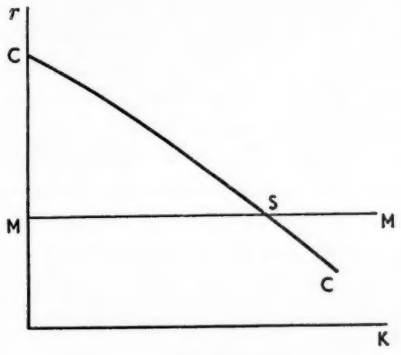

FIG. 1

other. As the stock of capital increases (other things being equal) its marginal productivity will decline; this gives us the falling curve CC. Against that, in the classical conception, we put a horizontal line MM, which represents a rate of interest below which people would not want to save, or would indeed dis-save, net saving becoming negative. Suppose these lines intersect at S. Then if the capital stock is lower than what corresponds to S, the rate of interest will be high enough to induce additional accumulation; the capital stock will accordingly rise towards S. If it tries to rise beyond S, the rate of interest will fall so low that there will be decumulation; so that S will be a point of stable equilibrium. S is the situation in the stationary state.

The older economists used often to write as if the stationary state was very far away; this must have implied that the CC curve was very elastic, so that capital could go on accumulating without forcing down the rate of interest very much. Some modern economists, impressed by the apparent exhaustion of investment opportunities at the top of a cycle, have become very doubtful about this. They have tended, more or less explicitly, to think of the CC curve as rather inelastic, so that (in the absence of new ideas) the process of accumulation would come to a stop

rather quickly. But how would it come to a stop? Would it end in a stationary state?

This also, from the same point of view, seems doubtful. The same ideas—carried over, we should notice, from short-period (Keynesian) theory—which cast doubt on the elasticity of the *CC* curve, have thrown suspicion on the horizontality of the *MM* 'curve'. What this curve shows is the rate of interest (or profit) below which accumulation will stop. To draw it horizontal makes it independent of *K*. But increase in *K* implies an increase in aggregate real income; and one of the things which are at the heart of Keynesian doctrine is the belief that saving is more affected by changes in real income than by changes in the rate of interest. If one takes this seriously, and believes that it is relevant to the present construction, one must abandon the horizontal *MM* curve. It becomes quite a question whether there is any sense in drawing such a curve at all; if one does draw it, it looks as if it should be drawn sloping downwards very sharply. If we start from a situation in which there is an incentive to accumulation, the effect of the realized accumulation will not show itself in a movement to equilibrium; the curves may fail to intersect before the rate of interest falls to zero. And it is not clear that there is a stationary state even at zero interest; there may be a persistent tendency to over-saving, with Keynesian unemployment.

Those economists who are most faithful to this line of thought are accordingly obliged to depart very far from the classical position. In their view, accumulation which is not accompanied by any expansion in the labour force or increase in technical knowledge must soon result in a jam; thus the fact that accumulation has been able to proceed, for a long time now, with no more than temporary jams must be ascribed to the growth of knowledge and to the growth of other resources than capital. The consequential rightward movement of the *CC* curve is therefore of much greater importance, for them, than the slope of the curve. In this way we arrive at the kind of growth theory which is associated with the names of Harrod and Domar; and of this the new theory of Kaldor (of which we heard a great deal at Corfu) may be regarded, from some angles at least, as a variant.

It will suffice, for present purposes, to express in these terms what is clearly the major line of division in this much divided field: the line between those who regard accumulation as being controlled, to some extent and in some manner, by something like a rate of interest—and those who regard this effect as so unimportant that their theory must run predominantly in other terms. Since the effect on the demand for capital which this latter group can recognize must be mainly an effect of the level of output, which the economy is trying to produce, on the capital

stock required to produce it—the same effect which in short-period theory is expressed in the Accelerator—it will be convenient, if dangerous, to refer to this latter school as 'Accelerationists'. It should, however, be understood that many of those who are unconvinced by the Accelerationist thesis as a mechanism of long-period growth would be quite willing to accept it for short-period purposes. One can perfectly well believe that short-period fluctuations have much to do with discrepancies between the actual and a 'desired' capital stock, and can yet maintain that changes in the 'desired' stock are controlled by quite different forces. It is distinctive of those whom I call Accelerationist that they are accelerationist in both the short and the long period. The alternative view (which was on the whole more strongly represented at Corfu) is quite consistent with a belief in the Accelerator, or something like it, as a factor in the generation of cycles; only for the analysis of long-period growth would it fall back on something which departs less far from classical doctrine.[1]

II

Indeed, after all the noise that the Accelerationists have made, it was something of a revelation to find what strong support there still is for the alternative view. And I should like to emphasise that this is not just an old-fashioned view that is taken by reactionaries—by people who have not been doing any hard thinking for some time about the particular matter in question. Quite as original and creative work is going forward on the one line as on the other. This is particularly the case among the Americans; their new methods in mathematical economics (Linear Programming and Activity Analysis) have put new life into the old theory, not into the Accelerationist theory. In the refurbished state in which it is now put forward by such writers as Samuelson and Solow it emerges as a very serious competitor.

No one could accuse the author of the famous article on 'Interactions between the Multiplier Analysis and the Principle of Acceleration'[2] of being neglectful of the short-period accelerator; it was nevertheless evident, from Samuelson's contributions to our discussions, that he does not find it natural to conceive of the long-period problem in the same terms. It may well be true (so I think the 'Americans' would say) that in the short run, while the economy is organized on the basis of techniques to which it is rather committed, the main factor determining the move-

[1] I may perhaps observe that the concept of Autonomous Investment (which I introduced into my own *Trade Cycle* (1950)) can be regarded as an attempt, which seemed sufficient for the purpose in hand, to avoid commitment to Accelerationism. It has of course been criticized by Accelerationists, as was to be expected.

[2] P. A. Samuelson, in *Review of Economic Statistics*, 1939.

ments of capital investment is the extent to which actual equipment is up to, or falls short of, the equipment which is needed for efficient production of the output which the economy is trying to produce; and yet that in the long run, when methods are more flexible, the growth of output is in the main a consequence of the capital accumulation which people are willing to undertake, and of its productivity. One can believe, without inconsistency, in the short-run accelerator and in the long-run Production Function.

The Production Function (output as a function of Labour and Capital applied), on which this approach is based, has indeed been heavily criticized —notably by Joan Robinson;[1] the validity of the concepts which it uses has been strongly denied. I shall not go into that question here, for it was the subject with which I dealt in my own paper to the conference, and my views upon it were little changed by the discussions. They will thus be available elsewhere. I will merely say that in my view the difficulties of principle involved in capital measurement are not fundamentally different from those which are involved in the measurement of all the *real* economic aggregates; any functional relation involving such aggregates is a simplification, to be used with circumspection, but the introduction of real capital as a term in the relation does not make it especially illegitimate. In itself the Production Function $f(L, C)$ does not worry me very much.

I am nevertheless a good deal worried by the particular Production Function which is used by the 'Americans'—as represented, not only by Samuelson and Solow, but also by Fellner, in the course of our discussions. The doubtful point is their maintenance of the 'neo-classical' assumption of *constant returns to scale*. This is a weakness that runs right through their Linear Programming, when it is lifted up from the 'micro' level, where it does such good work, and applied to the 'macro' problems of the economy as a whole. In the days of marginal productivity we needed a constant returns to scale assumption in order to make it possible for the factors to get their marginal products; but how do we know that the factors do get their marginal products? Are we to take it that the whole theory of monopolistic competition also is only valid in the short run? For my own part I find it hard to believe that increasing returns and growth by capital accumulation are not tied very closely together. I could quote authority (Adam Smith or Allyn Young[2]) for this belief; but it is more to the point to observe that there is work, from one of the same authors to whom I am referring, which tends in the same direction.

What I am alluding to is that intriguing paper of Solow's, 'Technical

[1] 'The Production Function and the Theory of Capital', *Review of Economic Studies* (1953–4), No. 55.

[2] 'Increasing Returns and Economic Progress', *Economic Journal*, 1929.

Change and the Aggregate Production Function',[1] in which he fitted to the American data for 1909–49 an $f(L, C)$ production function with a time trend. What seemed to be shown by this investigation was that the proportion of actual growth in output which was to be explained by capital accumulation, on the constant returns to scale assumption, was quite remarkably small. 'It is possible to argue that about one-eighth of the total increase [in productivity] is traceable to increased capital per man-hour, and the remainder to technical change.' It is tempting to rush from this to the conclusion that perhaps after all capital accumulation does not much matter; technical improvement (even the improvement which can be made without any capital accumulation) is the thing. One does notice a tendency to think in that way in some quarters, but it does not seem to me to be plausible. It may well be that it is an illusion which has only arisen because the particular production function chosen does not allow sufficient scope for the effect of capital accumulation on productivity.

If one assumes a production function with increasing returns to scale, the marginal productivity theory of distribution goes by the board; for the total of the returns to all factors, if they were all paid according to their marginal products, would exceed the total that there was to distribute. It is impossible that every factor should receive its marginal product; some, at least, must get less. Very likely everyone gets less. If to receive less than one's marginal product is to be exploited, everyone is exploiting everyone else. Such a system, as the monopolistic competition theorists have shown us, can perfectly well be 'in equilibrium' in the short period. Though the excess of the marginal product over the wage (or profit) rate gives an incentive to expand, there is no expansion for fear of 'spoiling the market'. If, however, we ask how such an economy can in fact expand, it is not difficult to see ways in which it can do so. Any sufficiently general expansion will make a market for itself. At the first round, something like the full marginal productivity of capital may go to the owner of the additional capital invested; then the gain is competed away by rising wages. No one, to my knowledge, has worked out a complete model on these lines; but if we are to work with a Production Function, it is in some such direction as this that further investigation should surely go.

III

Not much was heard at Corfu about these attempts at direct fitting of production functions to the empirical material; the inductive evidence which we did discuss, about which we did indeed hear a great deal, concerned the Capital–Output Ratio. From the point of view of the 'production function' school this is indeed itself a productivity concept. The

[1] *Review of Economics and Statistics*, August 1957.

'Incremental Capital–Output Ratio' is (the reciprocal of) marginal productivity; the overall Capital–Output Ratio, as usually measured, is a sort of average productivity. The terminology that has now become fashionable, clumsy as it is, has the advantage (if it is an advantage) that it does not commit one to the view that causation goes from factor to product, as neo-classical theory (very naturally, after all) supposed that it did. The way to the Accelerationist view that capital is in some sense a consequence of the output you want to produce from it is at least left open.

The economic indicators which statisticians find it easiest to measure are always average magnitudes. After the productivity of labour (*PMH*) they had to come to the productivity of capital (if that is what it is)—*COR*. And there they have certainly found a fine bone to throw to the theorists, in the shape of empirical evidence which seems to show that *COR*, at least in advanced countries, remains remarkably steady over long periods. We had much discussion about this constancy; but it should be said that the conference did not get encouragement, from its own statisticians, to build so much upon it. The American material, as presented by Goldsmith and Domar, was not made to look so very inviting. As is well known, there are no comparable British figures, since Barna and Redfern have been unable to reconcile the differences between the figures which they get by different methods. Hoffman presented us with a beautiful series for Germany, going back to 1850 (when Germany did not exist as a political unit); but this seemed to ride just too triumphantly through unification, war, inflation, and partition to be taken so very seriously. On the empirical side, the constancy of the *COR* is a plausible hunch, not yet by any means an established fact.

Suppose, however, that we do (provisionally) accept it, what does it signify? There is a pretty simple-minded check-up which throws some light upon the matter. If capital is K, profit P, and output O, P/O is the share of profits in output, P/K is the rate of profit on capital, and the capital–output ratio is K/O, which is P/O divided by P/K. Now P/O is another of these so-called 'steady' ratios (which some people say to be steady, others to be not so steady). If we accept that K/O is steady, and also accept that P/O is steady, it follows that P/K must be steady. If K/O is 3 (the kind of figure which is suggested by the American and by the German figures if each is taken at its face value), while P/O is (let us say) one-third, it will follow arithmetically that the rate of profit on capital is one-ninth, or about 11 per cent. That is certainly not an unbelievable figure; the question is whether a good deal of steadiness at this figure (or round about this figure), if we accepted it, would have any clear significance theoretically.

I think it is clear that if we accepted it, it would rule out some otherwise

possible theories; but it still leaves the chief issue, which I raised in the first part of this paper, entirely open. It is possible to explain an 'observed' constancy in the rate of profit on Accelerationist lines; this was how Kaldor seemed on the whole to explain it. It must then be maintained that there is a minimum to the rate of profit—not a classical minimum below which people won't save, nor a strictly Keynesian minimum below which they will hoard (that won't do, because we are working in real terms), but a semi-Keynesian minimum below which they won't undertake the risks of investment. 'Competition', it is then maintained (how this works I do not fully understand), will prevent the rate of profit rising, for long, above this minimum. In other words (looking back at our old diagram) Kaldor is introducing a new minimum line *MM*, which supports the rate of profit on grounds of risk-bearing, not on grounds of saving. But, since he still holds to a more or less Keynesian view of saving, he must then explain how it is that his economy, when it is down on its minimum rate, is not a prey to chronic over-saving. This from his point of view is a pretty nasty hurdle; the only source of rescue which is open, when one is being so Keynesian, is technical progress. It is a peculiarity of Kaldor's latest model that it 'builds in' technical progress. Instead of regarding it as an autonomous influence, coming from outside, as most economists have done, he regards it as something which in some sense is *obliged* to come to the rescue. This looks almost too good to be true, though I would not myself deny that there may be an element in technical progress which is of this character. But the importance of this element, relatively to a more random element, is surely a thing which may differ very much, in different times and places.

That is one way in which one may try to 'explain' these 'facts'; it should nevertheless be observed that the 'facts' (if they are facts) would be completely consistent with what appears, at least at first sight, to be exactly the opposite theory. Kaldor explains the (alleged) constancy of the profit rate by horizontality of his (new) *MM* curve; but it is equally open to us to explain it by returning to the view that the *CC* curve is, in the long run, highly elastic. This, indeed, as we saw, seems to have been the traditional idea. It may indeed be said to have been, after a fashion, verified in that paper of Solow's to which I have referred; for the production function which gives the best fit to his data turns out to be one with a high elasticity of substitution, so that its marginal curves would be highly elastic. But that, of course, is just because he is working with the same statistics as show the alleged tendency to *COR* constancy; there is the same 'identification' problem, as arises in the humblest cases of supply–demand curve fitting, over these major issues of macro-economic growth.

Having got to that point, we can look back in a rather detached manner at the rival theories we have been considering; we can regard them both with respect, though we are conscious, in each case, of their weak points. We can suspect that the 'production function' people have allowed themselves to be too much tied down by constant returns to scale; while we may feel that Kaldor has put too much faith in automatic technical progress—his *deus ex machina*. And then, if we look at them in the light of a little scepticism on these matters, we may wonder whether it is necessary that one should be right, the other wrong. Is it necessary that the same factors should be the dominant factors all the time? All these theories are in danger of becoming a little too 'cosmic'. They are in danger of imposing a pattern on history, in the manner of Marx, or Toynbee, or (dare I say it) of Rostow.

It is all very well for us to have *theories* of economic phenomena which constantly repeat themselves—like the formation of prices, the balancing of international payments, even the rise and decline of particular industries. But the long-run growth of an economy is not a thing that repeats itself: it does not repeat itself in different nations; their growth is all part of a single world story. One cannot argue from what did happen in the United States in a certain period so as to establish laws of economic development. All we ought to hope to get from our analysis is a better understanding of what did happen in the United States at that time. It is worth our while to construct theoretical models in order to improve our understanding of such phenomena. But the theorist, as such, is only a toolmaker; the explanation of what happened is the historian's business, not his.

All Souls College, Oxford

RETURNS TO SCALE[1]

By M. H. PESTON

THE problem of returns to scale is an interesting one, for a number of reasons. In the first place, what sort of scale effect exists in specific sectors of the economy is relevant to questions of policy, notably those concerned with monopoly and the concentration of economic power. Indeed, while the participants in the 'Empty Economic Boxes' debate were agreed on the importance of the laws of return to scale as applied to economic policy, this consideration appears to have been forgotten in later purely theoretic discussions.[2] Secondly, in virtually all branches of analysis, i.e. in any model (aggregated or disaggregated) in which production plays a part, the theorist is called upon to make some assumption or other concerning scale. The most frequently occurring example is, of course, the shape of the long-run supply curve either in the partial or general equilibrium theories of markets. Lastly, there is the growing tendency in economics to stress the role of measurement and quantitative testing of theories. The current state of the theoretical approach (or approaches) to scale is such that the laws which are formulated are either in principle not capable of being related to data, or are so vague in this respect that it is impossible to test them.[3]

It is for these reasons that an attempt is made in this paper to clarify the major issues by examining different ways of dealing with them. Three approaches are considered; they are labelled tautological, metaphysical, and common-sense, the terminology being used for convenience and not as a basis for *a priori* judgements of relative merit. Each approach represents a well-known form of argument in economics. It will be suggested here that the first two, while used frequently, act as impediments in the

[1] This paper arises out of discussions at the Staff Seminar on Methodology and Testing at the London School of Economics. The author is indebted to Bernard Corry and Basil Yamey for valuable critical advice and aid.

[2] A discussion stressing the importance of economies of scale and indicating some of the major questions which need to be answered in this context is contained in Joe S. Bain, *Barriers to New Competition*, Harvard University Press, Cambridge, Mass., 1956, chap. 3. Many other examples are to be found in the papers collected in Richard B. Heflebower and George W. Stocking (eds.), *Readings in Industrial Organisation and Public Policy*, Richard D. Irwin, Inc., Homewood, Illinois, 1958. Similarly, the subject of the 'relevant question' is raised by Milton Friedman in *Business Concentration and Price Policy*, A Conference of the Universities National Bureau Committee for Economic Research, Princeton University Press, 1955, pp. 237–8.

[3] The literature on returns to scale is enormous, and it would be impossible to list even the more important contributions in a footnote that ran to less than two pages. Luckily, an excellent bibliography is appended to E. H. Chamberlin's *Theory of Monopolistic Competition*, 6th edn., to which reference may be made.

path of scientific progress, the objective of the present analysis being to illustrate the way in which this happens.[1]

The following symbols will be used:

x_i = quantities of commodities, $i = 1, ..., n$

y_j = quantities of factors of production, $j = 1, ..., m$

$a, b, c, ...,$ are scale parameters.

An asterisk, e.g. x_i^* or y_j^*, signifies that the commodity or factor is fixed in quantity.

$y \to x$ = the process of production transforming quantities of factors given by the vector y into commodities given by the vector x.

Tautology

Let the factor combination $y = \{y_1^* \dots y_j^* \dots y_m^*\}$ be efficient for the production of the commodity combination $x = \{x_1^* \dots x_i^* \dots x_n^*\}$. By this is meant that y cannot produce a commodity combination larger than x (i.e. more of some commodities and no less of the others), and no smaller factor combination than y (i.e. less of some factors and no more of the others) can produce x.

It may then be asserted that $ay = \{ay_1^* \dots ay_j^* \dots ay_m^*\}$ is efficient for the production of $ax = \{ax_1^* \dots ax_i^* \dots ax_n^*\}$. The rationale of the assertion is as follows:

(i) x_i and y_j, $i = 1, ..., n$; $j = 1, ..., m$, are perfectly divisible, i.e. if x_i and y_j are physically possible quantities, then so are ax_i and by_j, where a and b are any positive real numbers.

(ii) The process of production $y \to x$ is perfectly reproducible, i.e. $y \to x$ can be carried out simultaneously a times, where a is any positive real number. The simultaneous operation of $y \to x$ a times is then taken to be equivalent to the process of production $ay \to ax$.

The assertion that the existence of the process of production $y \to x$ implies the existence of the process of production $ay \to ax$, so that there will always be constant returns to scale, is tautological because it is based solely on the definition of process of production. Given that this is what is meant by a process of production, nothing can be gained from an empirical investigation of returns to scale.

The definition is rather narrow, and may be extended to comprehend the possibility that the scale parameters are not free to take on all positive real values. In this way varying returns to scale may be brought into the picture.

[1] The styles of argument to be discussed are, of course, idealizations; possibly no contribution falls exactly into any one category. This mixing of methodologies, however, merely adds confusion to the obscurity resulting from faults in the methods themselves.

Consider the case of two factors and one commodity. Let $\{y_1^* y_2^*\} \to x_1^*$ be a possible process of production. This may still be efficient even if there is available another process of production, $\{ay_1^* cy_2^*\} \to bx^*$, $a, c < b$. The reason is that the quantities $a/b\ y_1^*$ of factor 1 or $c/b\ y_2^*$ of factor 2 may be physically impossible, so that the process of production, $\{a/b\ y_1\ c/b\ y_2\} \to x_1$, which would render $\{y_1\ y_2\} \to x_1$ inefficient cannot be used.

It will be noted that while indivisibility of some factors of production is a necessary condition for increasing returns to scale in the tautological approach, it is not sufficient.

Given the law of variable proportions the average cost curve may well have the shape shown in Fig. 1 where x_1, x_2, x_3, &c., are outputs at which

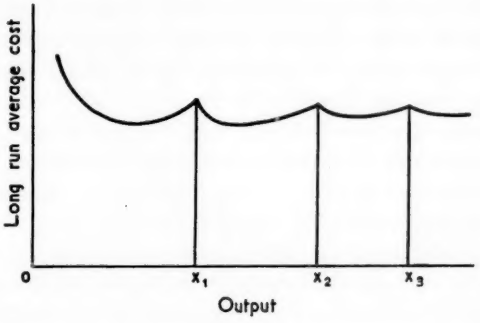

FIG. 1

additional units of the indivisible factor are introduced into the production plan. In this case there are ranges of both increasing and diminishing returns, but the general tendency over the whole cost curve will be constant returns.

It is perhaps fair to add that at this point the tautological approach may acquire an empirical flavour. If indivisibilities are the cause of non-constant returns to scale there may be an incentive to search for them in real industrial situations.

Metaphysics

The metaphysical method is similar to the preceding one in that it asserts that if all factors of production are free to vary in a given proportion, all commodity outputs will vary in the same proportion. It also accepts the proposition that indivisibilities of factors of production may lead to increasing returns to scale. A difference between the two approaches, however, is that the metaphysical sometimes employs the notion of a hidden or latent factor to explain away certain observations.

Suppose the following two processes of production are observed:

$$y \rightarrow x$$

$$ay \rightarrow bx,\ a \neq b.$$

The metaphysical contention is then that in specifying y and ay some hidden factor has been omitted. In other words, a factor which is included in y and ay in the real world has not been included in the observed y and ay, and it is this factor which has varied non-proportionately and caused the non-proportionate variation in x. If the comment were to be made in any actual case that there do not appear to be any other relevant factors to be taken into account, the metaphysical response would be to reiterate that the factor is latent and possibly unobservable.

The metaphysical approach is sometimes related to the linear programming analysis of the firm where apparently diminishing returns to scale may be comprehended in terms of upper limits to activities.

Consider any activity $A_i = \{a_{i1} \ldots a_{im}\, a_{im+1} \ldots a_{in}\}$ where the first m negative elements are factor inputs and the remaining $n-m$ positive elements are commodity outputs. In the usual linear programming analysis A_i may be operated at any non-negative level x_i, implying that there are constant returns to scale with respect to activities.

Suppose a case of apparently diminishing returns arises which conflicts with this constant returns assumption. It may be dealt with by placing an upper limit on the level of operation of A_i, i.e. by introducing an element equal to -1 into the activity vector, and another element equal to minus the upper limit of operation of the activity into the resources vector. A_i would now be written out as $\{a_{i1} \ldots a_{im}\, -1\, a_{im+1} \ldots a_{in}\}$.

The metaphysicist notes that -1 appears in A_i in the same way as the factor input elements, and the upper limit of operation of A_i appears in the resources vector in the same way as the quantities of the fixed factors. After this it is a simple matter to translate this formal mathematical phenomenon into an indication of a latent factor, limited in supply, which causes diminishing returns.

Common Sense

Assuming that a law of returns to scale is intended to refer to observable phenomena, it should be formulated in such a way that there is some advantage to be gained from testing it. The main criticism to be made of the previous approaches is that neither is conducive to empirical investigation of the subject. While it is by no means beyond the ability of economists to invent indivisibilities or postulate hidden factors, and perhaps explain away all or most peculiar cases of returns to scale, it

seems to be a little more difficult to justify this procedure in terms of the gains that are supposed to follow from it.[1]

Consider the well-known farming example in which the output of grain is doubled by doubling all factor inputs except the fencing around two adjacent fields. The tautological approach is obliged to treat this as a case of indivisibility or of incorrect description of the processes of production, while the metaphysical method has the additional choice of latent factors. The difficulty with the indivisibility explanation is that it is by no means clear what is indivisible. Certainly, the factors of production specified as acreage of land, quantity of fencing, labour, seed, etc., appear to be divisible.

An explanation in terms of the incorrect description of the processes of production looks more promising. Land in one place is not the same as land in another place. It may be argued, therefore, that what has happened is not that the quantity of land has doubled, but that an additional factor, land of type 2, has been brought into the production process to be operated as an input in association with land of type 1. In other words, the proper conditions for applying a law of returns to scale do not hold in this case.

Unfortunately, such an explanation is rather treacherous, for it implies that the proper conditions for a law of returns to scale rarely, if ever, hold. Since all factors of production have both a spatial location and a spatial extension, any variation in the quantity of a factor involves immediately a variation in its nature if spatial characteristics are an integral part of that nature.

The hidden factor explanation also emphasizes spatial location, but in a slightly different way. It asserts that spatial location is itself a factor of production the variation of which has permitted the seeming economy in fencing.

It is of course true that if the additional acreage were not adjacent to the initial acreage, the economy in fencing would not be forthcoming, but this information is of little help in formulating a law of returns to scale, or in understanding precisely what has happened in the example

[1] Kaldor has taken the position that all economies of scale are best treated in terms of indivisibilities. It is not in the least clear from his paper, however, what he gains from this interpretation. Indeed, the methodological convenience to which he refers seems rather to be the methodological inconvenience of searching for indivisibilities the discovery of which does not explain what happens to firms as they grow larger. N. Kaldor, 'The Equilibrium of the Firm', *Economic Journal*, March 1934, pp. 61–76. It is perhaps not superfluous to remark here that it is not the intention of the present paper to deny the existence of indivisibilities but merely to throw doubt on their all-embracing nature. A description of a number of cases where the existence of a natural basic unit of a factor of production may be important is to be found in Edwards and Townsend, *Business Enterprise*, Macmillan, London, 1958, pp. 166–72.

under consideration. The question may be asked: If spatial location as a factor of production has varied, has it varied more than, less than, or equi-proportionately to the other factors and output? There seems to be no way of providing an answer, and once again the problem is solved by removing the whole notion of a law of returns to scale.[1]

The farming example is not the only one where logical difficulties in the tautological and metaphysical approaches to returns to scale occur. Indeed, where apparently increasing returns to scale result from the operation of the law of large numbers, their shortcomings are even more pronounced. Those cases in which stocks to maintain a given probability of depletion vary less than proportionately with output contain neither indivisibilities nor improper specification of factors. Thus, the tautological approach is left with nothing to say, while the postulating of a hidden factor in the metaphysical method serves merely to spotlight its empirical irrelevance.

The common-sense view in all these cases is to take them at their face value. On the basis of actual observation the problem is to determine whether proportionate variations in factors lead to proportionate variations in the outputs of commodities, or whether proportionate variations in outputs require proportionate variations in factors. Moreover, the empirical bias here does not rule out the need to explain why certain processes of production have peculiar characteristics. In other words, nothing is lost, and there is the gain of having laws which may be quantified. Spatial location is important in the farming example, and so is the law of large numbers in the stock control example. The existence of these causes of non-proportionate variations, however, does not necessitate the reinterpretation of observations so that eventually the entire concept of returns to scale must be abandoned. Indeed, the foundation of the common-sense view is the assertion that the discovery of a cause for non-constant returns to scale is not equivalent to the discovery of a factor of production which *really* ensures constant returns to scale.

The connexion of the foregoing with measurement and the testing of economic theory is straightforward. The relevant concept here is the production function, $x = f(y_1, ..., y_m)$. The argument being presented is that it cannot be taken as an *a priori* datum that this is homogeneous of degree unity, and that even for integral λ it is an invalid procedure to assert that $f(\lambda y_1, ..., \lambda y_m) = \lambda f(y_1, ..., y_m)$.

In the usual econometric investigation into the production function

[1] To stress the point further one may compare the rationalizations of the tautological and metaphysical approaches with the classical treatment of factors which are measurable, may be traded in markets, and are variable in such a way that it is possible to include them in a production function in which the law of variable proportions holds.

both the output and input variables are aggregates or index numbers.[1] They relate to factors of production defined as broadly as labour or capital, and to commodities defined as broadly as the output of specific industries or of the economy as a whole. In this case the simple theorizing discussed so far does not provide any foundation for a homogeneity postulate to be introduced as a constraint on the statistical estimation of the function. Indeed, one of the interesting questions which such a quantitative analysis would be expected to answer is whether the homogeneity postulate stands up to testing or not.

At the more refined level of the firm the situation is rather more complicated. At the one extreme, precise quantitative data are sometimes available in the form of engineering production functions, although even here an index number problem may arise from the existence of multi-product operations. At the other extreme, much less is known about the behaviour of variables which are not strictly technical in character. Since economic theory is formulated in terms comprehending both types of variable, it would be a mistake to base any analysis solely on what is known about the behaviour of only one of them. In particular, it would be extremely dangerous to use engineering data as the sole basis for testing micro theory.

The common-sense approach allows for the existence of increasing, decreasing, and constant returns to scale. It accepts the position that while the concept of returns to scale is useful, no general empirical law of returns to scale can be formulated as true for all processes of production in the economy.

It is sometimes suggested that this position is too agnostic, and that the possibility of perfect reproducibility of a process of production automatically rules out diminishing returns to scale. Consider the process of production $y \to x$. If the output combination ax is required, the process $y \to x$ may be reproduced separately a times, and this is equivalent to using the process $ay \to ax$. As a result the process $by \to ax$, $a < b$, would be inefficient.

Countering this argument, it may be noted that although the notion of perfect reproducibility is occasionally of value, for a number of problems

[1] Caleb A. Smith, 'Survey of Empirical Evidence of Economies of Scale', in *Business Concentration and Price Policy*, A Conference of the Universities National Bureau Committee for Economic Research, Princeton University Press, 1955, pp. 216–20. It seems to the present writer that Smith makes too much of the aggregation problem as a difficulty in constructing cost curves. These can be formulated for any degree of aggregation of the relevant variables, and may be measured if suitable data are available. The important questions to be asked are whether the production function so formulated can play a useful part in the construction of economic models and whether empirical regularities between the variables can be discovered in the data. It would be a hopeless state of affairs if only completely disaggregated production functions (whatever that may mean) were deemed to be admissible in economic theory.

it is irrelevant. A law of returns to scale may be of interest to the economist only if it is or potentially is related to an economic organization, for example, a firm. Now, given that variations in the scale of operations within an organization are important, doubling that scale by reproducing exactly the existing state of affairs on the input side does not necessarily lead to doubling on the output side. The reason is that within the organization the two identical parts may become interrelated, and it is impossible to decide *a priori* what effects the interrelationships will have. A firm may have the option of setting up one or two or more identical factories, but this does not imply that these will be operated independently of one another.

In symbolic terms, consider two factor combinations, y and y', such that $y = y'$. While it is true that $y \to x$, and $y' \to x$, it does not follow that $y + y' \to 2x$ if $y + y'$ is a factor combination within the same organization. This method of obtaining diminishing returns to scale may be explained away by arguing that formulating the law within an organization is equivalent to postulating a fixed factor, namely the organization. The point made in this paper is to agree that one is always free to explain anything away, but that what happens here is that returns to scale are then removed altogether.

Conclusion

An attempt has been made to show that a common-sense approach has certain advantages not possessed by other approaches to the problem of returns to scale, and that it is not possible to determine absolutely what scale phenomena will appear in the real world. In addition, it has been suggested that the alternative approaches of tautology and metaphysics rely heavily on restriction and rationalization, obscuring basic issues and impeding the search for new problems and new discoveries. The attempt to use them to 'save the appearances', as it were, appears to have few if any advantages, and in the opinion of the present writer they have not even such merits as theoretical simplicity, aesthetic attraction, or logical completeness. While it may be accepted, therefore, that it is impossible to present proofs of right or wrong in a methodological discussion, there seems to be a reasonably good case for sticking to common sense as the foundation for scientific investigations in this field.

The London School of Economics

ISRAEL: TEN YEARS OF ECONOMIC DEPENDENCE[1]

By S. RIEMER

THE inevitable point of departure for any meaningful review of economic developments in Israel during the first 10 years of independent statehood are the vast demographic changes which took place during that period which can conveniently be grouped under three principal headings:

1. The mass exodus of native Palestinian Arabs during the months of warfare preceding and following the proclamation of the State on 14 May 1948.
2. The mass immigration of Jews, particularly during the 3 years June 1948 to 1951.
3. Natural increase.

Estimates of the original number of Arabs who fled from the territory which now constitutes the State of Israel vary widely, from 600,000 to 1,300,000. The most reliable estimate, which curiously enough was gleaned from an official U.S. Government publication, puts the number at a round 750,000.[2]

Net immigration of Jews to Israel, i.e. the excess of all arrivals over all departures, period May 1948 to December 1957, amounted to 825,000 in round numbers.[3]

Natural increase of Jews, i.e. the excess of all live births over all deaths, period May 1948 to December 1957, came to 294,000.

The Jewish population of the country increased, therefore, by about 1,120,000 from an estimated 650,000 in May 1948 to 1,770,000 at end-December 1957, which represents an increase of 171 per cent. About 76 per cent. of the total Jewish population increase was due to net immigration and the residual 24 per cent. represents natural increase.

[1] The original version of this article was confiscated by the Israel authorities at Lydda airport on 14 Oct. 1958, when I was *en route* to Cambridge to take up the S. B. Cohen Research Studentship of King's College. Fortunately, after vigorous protest, the manuscript was restored to me in time to be submitted for, and awarded, the Stevenson Prize of Cambridge University for 1958. This version differs from the original in two respects: some minor cuts were made, mainly of theoretical generalizations, and footnotes were added.

I should like to record my great debt of gratitude to Professors R. F. Kahn and James Meade for their constant encouragement and unfailing helpfulness in bringing this article to publication.

[2] N. Lawrence, *Jewish Population and Immigration*, U.S. Dept. of Commerce, Bureau of the Census, International Population Statistics, Series P-90, No. 2, Washington, 1952, pp. 57–58.

[3] All demographic data on Israel were obtained from the Monthly Statistical Bulletins of Israel (in Hebrew only since mid-1953) and the bilingual annual Statistical Abstracts of Israel, both published by the Central Bureau of Statistics.

The non-Jewish, predominantly Moslem Arab, population of Israel increased from an estimated 138,000 at the beginning of 1949 to 213,000 at the end of 1957, mainly by virtue of a high rate of natural increase.

The total human population of the area which now encompasses the State of Israel remained, therefore, comparatively stable during the period under review, increasing from about 1,530,000 at the end of 1947 (i.e. before the departure of any local Arabs) to 1,976,000 at the end of 1957. All that really happened was an exchange of Jews for Arabs which affected roughly half of the total human population. The increase of 30 per cent. in the total population of the country was principally due to natural increase, which would have occurred in any case.

However, from an economic point of view the population exchange had most far-reaching effects. During the Mandatory period the Palestine economy had consisted of a Jewish sector and an Arab sector held together by little save a common political framework. The differences between the two sectors had been striking both as regards the type of economic activity pursued and the standard of living prevailing in them. During 1947 the average *per caput* national income of the Arabs reached just 40 per cent. of that of the Jews (as against 34 per cent. only in 1936).[1] According to the Mandatory industrial wage survey of February 1947 average hourly cash earnings of Arab adult males came to 42 per cent. of those of comparable Jews—80 mils against 190 mils.[2] If we were to add the much higher scale of social charges obtaining among the Jews the difference would be higher still. Jewish immigrants were absorbed in the Israel economy, which is an economic outgrowth of the Jewish sector of the Mandatory economy, at the general living standards and wage rates prevailing there. It follows that for every Jew who replaced an Arab wages and living standards rose by about 150 per cent. Since roughly half of the total population was affected we may conclude by saying that the population exchange had the effect of raising over-all wages and living standards by half that amount again, or by 75 per cent. Alternatively it can be argued that the virtual liquidation of the Arab economic sector, owing to the mass flight of its inhabitants, provided no off-setting balance to the near trebling of the population base of the Israel economy. According to that view we are justified in speaking of a vast (Jewish) population increase in the Israel economy brought about by mass immigration within a very short time-span.

In the ensuing analysis this second point of view will be adopted in order to obviate the need to account for demographic changes in terms of

[1] Dr. A. L. Gaathon, 'The National Income', *Encyclopaedia Hebraica*, vol. vi, Palestine, 1956–7, Jerusalem–Tel-Aviv, pp. 729–31 (Hebrew).

[2] *General Monthly Bulletin of Current Statistics*, vol. xii, No. 12, Dec. 1947, Government of Palestine, Dept. of Statistics, pp. 793 and 799.

wage changes. However, as we shall have occasion to see, economically there is not much difference between the (more than) *doubling* of the (Jewish) *population* at *stable wage rates* and the (almost) *doubling* of the *wage rates* of a *stable* (total) *population*.

In economic terms the significance of a given population increase resides in the doubly augmented aggregate demand it generates in the economy: first, as consumers, for additional consumption goods, and second, as producers, for additional job opportunities. Economic absorption is the process by which additional work-places are created for the new population with the help of which they can meet their own augmented demand for consumption goods. How great, in quantitative terms, was the additional demand for jobs generated by the demographic changes? By international convention a country's working-age population is generally defined as comprising all persons aged 14 years plus. Available statistics for Israel permit of an estimate of the Jewish working population for age-groups 15 years plus only. Concerning the rate of change, which is what we are ultimately after, the possible difference between the two sets of figures is inconsiderable. During the 10 years end-1947 to 1957 the Jewish working population of Israel increased from 444,317[1] to 1,150,210,[2] or by 705,893, being a rate of increase of nearly 160 per cent. Assuming that the same percentage of the Jewish working-age population participated, or sought to participate, in the country's labour force on both dates, then the supply of labour in the economy grew by a similar extent. Assuming finally that at the outset of the period economic job opportunities were adequate for the then available Jewish labour supply, then we reach the conclusion that during the first 10 years of the State's existence, the demand for jobs in the economy, which is just a reciprocal of the supply of labour, increased by about 160 per cent.

How does a national economy go about multiplying its supply of jobs by over two and a half times? Well, economics knows of two principal, alternative ways: increasing the supply of productive capital proportionately to the increase in the supply of labour, or decreasing the price of labour, i.e. real wage rates, commensurate with the unilateral increase of the labour supply. Understanding of these two alternatives, which is absolutely crucial for the whole subsequent analysis, requires consideration of two basic theoretical economic generalizations.

The first is the so-called Law of Diminishing Marginal Returns. The second theoretical generalization is that employment of all productive inputs (and therefore of labour) is always pushed to the point where the

[1] M. Sicron, B. Gil, *The Jewish Population by Sex, Age, and Country of Birth (1931–1954)*, Central Bureau of Statistics, Special Publications No. 37, 1955–6, Jerusalem, p. 5 (Hebrew).
[2] *Statistical Abstract of Israel*, No. 9, 1957–8.

additional outlay for hiring another unit is just offset by the additional income accruing to the employer as a result. The volume of employment will always be determined where a worker's marginal cost is just equal to his marginal revenue. This in fact is our definition of economic employment.

The two principal variable factors of production in a modern economy are labour and capital. If the increase of the labour supply in the Israel economy remained in the nature of a unilateral movement unaccompanied by a comparable expansion of the capital supply, then by activating the Law of Diminishing Marginal Returns the marginal productivity of labour would drop. The only way to augment employment then would be by a reduction of wages, i.e. the marginal cost of labour, commensurate to the reduction in the marginal productivity of labour, and designed to keep the balance between marginal cost and marginal revenue product as explained above. If, however, the 160 per cent. growth in the labour supply was matched by a corresponding growth in the (productive) capital supply, i.e. of new farms, factories, power-stations, &c., so that the former labour–capital input ratio was preserved, then it would be possible for the new immigration to be productively absorbed into the national economy at existing wage rates and living standards. It also follows that in so far as the capital supply expansion exceeded the corresponding labour supply expansion, full economic employment could be had at rising wage and living standards. Finally, if the expansion of the capital supply lagged behind the growth of the labour supply while wages remained pat then the inevitable outcome would be the emergence of unemployment in the economy.

It is worth noting in passing that the wage level is of great importance for the creation of new job opportunities through capital investments too, and that in three distinct respects: Firstly, the lower the wage the lower the amount of capital required per new job created, so that a given supply of capital goes farther in creating new jobs. Secondly, the lower the wage the more labour-intensive will be the methods of construction, &c., employed in the investment sector itself, thereby once again generating more jobs in the economy. Thirdly, the lower the wage the greater generally will be the share of available economic resources, and above all of capital imports, that can be diverted from current consumption to investment, so that the supply of capital investment funds is greater than would otherwise be the case.

The next step in our analysis will be to ascertain what happened to real wages and the supply of capital in the economy during the 10-year period under review.

According to a series of special wage surveys conducted at various dates in Jewish industry, the hourly earnings of adult males increased from

£I 0·190[1] to £I 1·075[2] during the period February 1947 to November 1954, or by 466 per cent. A monthly index of daily wage earnings in industry, comprising all ages and both sexes, computed on an annual average basis 1948–57, also yields an increase of exactly 466 per cent., from £I 1·889 to £I 10·691.[3] The same period saw a considerable expansion in the scale of social charges, directly payable by employers to employees, which may very conservatively be estimated to have risen from 15 per cent.[4] to 27 per cent.[5] of cash wages. Total labour costs, i.e. cash wages plus social charges, increased therefore from £I 0·218 to £I 1·365 hourly according to our first measure, and from £I 2·172 to £I 13·578 daily by our second measure, being in both cases an increase of 525 per cent. As against this the consolidated cost-of-living index (September 1951 = 100) rose by only 208 per cent. according to our first measure (from 74 to 228 points in the period February 1947 to November 1954) and by 187 per cent. according to our second measure (from 92 to 264 points, annual average 1948–57).[6] It follows that *real* total labour costs in the Israel economy over the aforementioned periods rose by 102–118 per cent. respectively.

Viewed purely in trade union terms the doubling of real wages while the supply of labour increased by over two and a half times, and all that in less than 10 years, is an astounding feat. It testifies above all to the tremendous power position occupied by the Histadruth (labour federation) *vis-à-vis* the State and society. Beyond that, these results were achieved by a policy judiciously blending Dr. Jekyll and Mr. Hyde. Throughout the year Dr. Jekyll affirms that all he wants is to protect the workers' living standards against the encroachments of inflation by linking wages in a quasi-automatic fashion to movements of the cost-of-living index. Comes the end of the year and with it the time for negotiating new wage contracts, and the reasonable Dr. Jekyll suddenly makes way for a fanatic Mr. Hyde who ruthlessly pushes through sweeping increases in basic wage rates all round. No sooner have these been secured than the

[1] *General Monthly Bulletin of Current Statistics*, Govt. of Palestine, Dept. of Statistics, vol. xii, no. 12, Dec. 1947, pp. 788–853.

[2] *Statistics of Wages, Workers and Salaried Employees (1953–1954)*, Central Bureau of Statistics, Special Publications No. 38, Jerusalem, 1955–6 (Hebrew).

[3] *Monthly Statistical Bulletin of Israel*, Central Bureau of Statistics.

[4] *Broadsheet for Occupational Statistics and Information*, Histadruth, Dept. for Statistics and Information, pamphlet 6, Tel-Aviv, 1947, p. 15 (Hebrew).

[5] *Statistical Compilation 1956*, No. 1, Histadruth, Institute for Economic and Social Research, Tel-Aviv, 1957, p. 59 (Hebrew). The calculation concerning the increase in social charges is also based on supplementary information kindly supplied by Mr. Goldberg, Chief Accountant, Diskin Construction Company, Jerusalem, according to which compulsory State insurance rose from 2–3 per cent. to 5·9 per cent. from 1947 to 1956. For an alternative calculation, yielding a higher rate of increase in social charges, by over 17 per cent., see the above two Histadruth sources, pp. 12 and 58, respectively.

[6] S. Riemer, 'Inflation in Israel', *Public Finance*, vol. xii, no. 3, 1957, p. 274, and *Monthly Statistical Bulletin* of Israel.

hideous visage of Hyde fades out of the picture and a blandly-smiling Jekyll, all sweet reasonableness, emerges once more to hold the new line for another year. The process by which wages are fixed in Israel is called collective bargaining. But the only real bargaining that ever goes on is between the wage claims advanced by different political factions *within* the Histadruth. Once these have been resolved, usually by Mapai steam-rollering, the results are handed down to the manufacturers or other group of employers, who are expected to sign on the dotted line after the merest expressions of horror and revulsion. At the beginning of 1957 basic wage contracts were signed for 2 years and certain changes were introduced in the operation of the cost-of-living allowance mechanism, both of which have had the effect of slowing down the upward thrust of wages.

The growth in the supply of capital since 1948 has been fed from two main sources: net domestic investment and Arab-abandoned property.

For the 9 years 1949–57 net physical capital formation in the economy has been estimated at £I 3,850,000,000[1] in 1956 prices, which is just 24 per cent. of the net national product.[2] At an exchange rate of £I 2·000–$1·00 this equals roughly $1,925,000,000. Only a little over half of this investment was in productive facilities, i.e. the sum of investment in agriculture, mining, manufacturing, power-generation, transport, and tourism. Of the remainder the lion's share went to the provision of residential housing.

The value of Arab-abandoned property, consisting primarily of arable land, plantations, and dwellings, was estimated by the United Nations at £120 million[3] or, say, $360 million, as at the end of November 1947. In the chaotic conditions prevailing during 1948 these properties suffered extensive damage owing to warfare and neglect, so that the real net value of Arab-abandoned properties which accrued to the Israel economy after the cessation of large-scale hostilities in early 1949 was much less, certainly no higher than $250 million.

The total net accretion of new capital in the Israel economy during 1948–57 may therefore be put at a round $2·2 billion. This equals roughly $2,700 per new immigrant or rather less than $2,000 *per caput* of the total Jewish population increase, immigrants plus natural increase.

How adequate was this growth of the capital supply to permit the full

[1] L. Eshkol, 'Capital Import and its Countervalue in Defence, in Development and in Production', reprint from Hebrew daily *Davar*, Dec. 1957; and Bank of Israel, *Annual Report, 1957*, p. 12 (Hebrew).

[2] *Summary of National Accounts for Years 1950 to 1956 in Current Prices and in 1956 Prices*, mimeographed, Dec. 1957, p. 3; *Annual Report, 1957*, Jerusalem, 1958, p. 12; both Bank of Israel (Hebrew). The calculation relates only to the period 1950–7.

[3] Progress Report of the United Nations Conciliation Commission for Palestine covering the period from 23 January to 19 November 1951, U.N. General Assembly, Official Records, Sixth Session, Supplement No. 18 (A'1985), Paris, 1951.

productive integration of a 160 per cent. augmented labour supply in the national economy at living standards and wage levels twice their original height at the beginning of a 10-year period?

During the early years of the State the economic absorption cost per new immigrant (not per new gainfully employed) was officially estimated at $2,200,[1] including in addition to the provision of new jobs and dwellings all ancillary social overheads such as schools, hospitals, roads, &c. This figure was reached by applying a capital–output ratio of somewhat above 3 : 1 to a *per caput* national income of £I 250 or $700[2] (at the then official exchange rate of $2·80–£I 1·000). At $2,200 *per caput* actual new capital creation was more than enough for the new immigration, but it was rather below the economic absorption needs of the total population growth, immigration plus natural increase. However, the estimate of $2,200 *per caput* was specifically rooted in the central assumption 'that the present level of productivity, standard of living, mechanization, public services and general way of life would persist'. Following the doubling of real wages the capital intensity of new investment also had to be raised to push the marginal productivity of labour to the higher real wage level, and that not only with respect to the new immigration, but for the entire labour force of the country. At the same time the precipitate rise of living standards called for higher non-productive investments *per caput*, pre-eminently in the provision of dwellings.

In the field of agricultural settlement, for example, planned investments rose from about $7,500 to $15,000 per agricultural unit or household during 1948–50 to 1955–7.[3] Over the same period the standard of immigrant housing increased from 24–28 sq. metres in area and low-quality construction to 42–48 sq. metres in area and comparatively high-quality construction.[4] In both cases we find a doubling of standards roughly comparable to the doubling of real wage and living levels.

According to estimates of the Bank of Israel the net national product of Israel increased during 1950–7 by about 116 per cent. in real value terms

[1] *Prospectus: $500,000,000 State of Israel Independence Issue*, American Financial and Development Corporation for Israel, 1951, p. 3. The actual figures given there are $1·5 billion for 600,000 immigrants, or $2,500 *per capita*, but the next source (2) makes it clear that $300 of that sum comprised 'first-aid' assistance, mainly for financing the stay of new arrivals in immigrant camps, &c.

[2] These details as well as the following quotation were gleaned from an earlier draft of the Independence Bonds issue which was kindly put at our disposal by the late Prof. A. Bonne of the Hebrew University, Jerusalem.

[3] The figure for the earlier period is based on records of the Jewish Agency Colonization Dept.; for the latter period: *Planned Colonization Outlays*, mimeographed booklet published by Jewish Agency Colonization Dept., 1957, Jerusalem (Hebrew). In both cases original Israel pound values were rendered into dollars at official exchange rates. The estimate is approximate only because planned investments vary widely with type of settlement.

[4] Ch. Darin, *Housing and Absorption in Israel 1947/48–1954/55*, Tel-Aviv, 1954–5, pp. 40 and 45 (Hebrew).

(from £I 1,208 to £I 2,604 million in 1956 prices).[1] On the basis of this and the aforementioned economic absorption estimates, the guess might be hazarded that the actual volume of new capital supply may have been sufficient for facilitating the integration of the new labour supply productively in the economy, at the wage levels and living standards prevailing at the outset of the period. Alternatively it may conceivably have been enough to raise real wages and living standards of the old-settled population, plus their offspring, to their present levels. But what that volume of new net capital creation could never have accomplished is to double the real price of a more than doubled labour force, all during one and the same 10-year time-span.

The upshot of the contradictory developments in the labour market was the crystallization of an excessive wage level, excessive in the specific economic sense of not permitting full economic employment of the available labour supply seeking jobs.

As our next step we must accordingly apply ourselves to the task of estimating quantitatively the total under-employment of human resources in the economy, or the overall paucity of economic job opportunities.

The only current unemployment datum in Israel is the registration of unemployed at the labour exchanges, which is published monthly. These have never exceeded 20,000 daily and for most of the time are much lower. Over the last 3 years, 1955–7, the annual average of daily registered unemployed has fluctuated between 10,000 and 12,500.[2] Calculated as a percentage of the labour force, registered unemployment dropped from about 2·5 per cent. in 1949 to 1·5 per cent. in 1951 (this during the peak period of mass immigration), then rose to an all-time high of 3·5 per cent. in 1953 and finally fell back once more to less than 2 per cent. during 1955–7. For England Lord Beveridge thought an unemployment rate of up to 3 per cent. compatible with full employment. For Israel the comparable rate would certainly have to be higher. It follows that on the basis of official unemployment registrations the Israel economy actually suffered from over-full employment for most of the period reviewed.

To get at more realistic estimates of total economic unemployment in Israel it is necessary to analyse the published findings of five sample labour force surveys which the government has conducted in recent years, one each in the years 1954–6 and two in 1957. The first labour force survey of June 1954 was largely in the nature of an experiment and as such may be discounted for our present purposes. The figures cited below

[1] *Summary of National Accounts for Years 1950 to 1956 in Current Prices and in 1956 Prices*, mimeographed, Dec. 1957, p. 3; and *Annual Report, 1957*, Jerusalem, 1958, p. 12, both by Bank of Israel (and in Hebrew).

[2] *Monthly Statistical Bulletin* of Israel.

are rough averages of the remaining four surveys for 1955–7,[1] relating to the Jewish population only.

Israel's grave employment situation is revealed by three basic measurements:

Firstly, total full-time open unemployment, which at 41,000–45,000 or roughly 7 per cent. of the civilian labour force is approximately four times the size of registered unemployment.

Secondly, the participation of the working-age population (14 years plus) in the civilian labour force. Generally we find that the wealthier a country in terms of *per caput* national income the lower is the participation of its working-age population in the labour force. This is due among others to the more protracted education of the young and the earlier retirement of the aged which rich countries can afford, and sometimes also because of less female employment outside the home, though this factor is subject to far-reaching cultural influence. Thus the United States of America, the wealthiest country in the world, is associated with one of the lowest civilian labour force participation rates, of less than 60 per cent.[2] In Europe we find rates of 60–65 per cent., while in poorer and less developed countries rates of above 70 per cent. are not rare. Israel, a comparatively poor country, exemplifies civilian labour force rates which at about 52–55 per cent. are considerably below even those of the U.S.A.

Thirdly, the distribution of the labour force by principal branches of economic activity. There exists overwhelming comparative factual evidence that the percentage of a country's labour force engaged in commodity production (agriculture, mining, manufacturing) is inversely related to its *per caput* national income, while the percentage engaged in trade and services moves in direct relation to its *per caput* national income.[3] Israel apart, the U.S.A. with a *per caput* national income of nearly $2,000 heads the list with the lowest labour force share in commodity production and far and away the highest labour force percentage in trade and services (about 40 and 42 per cent. respectively according to the 1950 population census). Now Israel, with a *per caput* national income of about one-fourth of the U.S.A., engages a still lower share of its labour force in commodity production, only about 38 per cent., while its trade and services sector, accounting for about 44·5 per cent. of its labour force, is significantly higher than that of America.

And even that is not yet the end of the story. The American figures

[1] *Labour Force Survey, November, 1955*, Special Publications No. 61, Jerusalem, 1957; and *Labour Force Survey, 1957*, a reprint which gives summary comparative tables for all four surveys, both by Central Bureau of Statistics (Hebrew).

[2] *Annual Report on the Labour Force*, Current Population Reports, Labour Force, U.S. Dept. of Commerce, Bureau of the Census, Series P–50, Washington D.C.

[3] *Yearbook of Labour Statistics, 1955*, I.L.O., Geneva, 1955, table 4, pp. 10–35.

include, in accordance with international convention, the armed forces in the services category, while the Israel percentages do not, owing to security considerations. For 1955, unofficial published estimates put Israel's armed strength at 50,000.[1] If we add that number both to the labour force (thereby turning it in fact from civilian to total labour force) and to services, we reach the staggering conclusion that near enough one out of every two Israelis who is economically active derives his livelihood from trade and services.

Both the participation in and the distribution of the labour force in Israel reflect above all the terrible deficiency of economic job opportunities. With respect to participation rates, owing to the comparatively low living standards prevailing in Israel (low, that is, in comparison with the U.S.A.) and the downright physical want suffered by large segments of the new immigrant population, there cannot be the slightest doubt that if only more jobs were available they would readily be taken up. Concerning the distribution of the labour force, there is no economic justification whatsoever why Israel's civilian services sector should exceed America's total services sector, i.e. inclusive of its armed forces, by more than 25 per cent. (about 31 per cent. as against less than 24 per cent.). In fact, Israel's civilian services sector is the single biggest reservoir of concealed unemployment and fulfils in that respect an analogous function to subsistence agriculture in underdeveloped countries.

Raising the participation of Israel's working-age population in the labour force from its present level of 52–55 per cent. to no more than 60 per cent. would yield an addition of about 70,000 to the civilian labour force. Reducing the share of Israel's trade and (civilian) services sector from 44·5 per cent. of the labour force to no less than 30 per cent., roughly equal to that of Belgium and Sweden, would result in the transfer of another 80,000 to more productive employment.

Finally, halving total full-time open unemployment would add at least 20,000 to the employed labour force.

By way of rounding off this survey attention must be drawn to three more pockets of concealed unemployment.

The first one concerns the various public works schemes for otherwise openly unemployed which are freely admitted to be in the nature of indirect unemployment assistance. Their social usefulness and the level of labour productivity attained in them are correspondingly low. In recent years public works have provided about 13,000 man-days daily.[2]

[1] A. Hovne, *The Labour Force in Israel*, vol. i, Falk Project for Economic Research in Israel, Jerusalem, 1956, pp. 113–15, 119.

[2] Government Yearbooks, and *Trends in Employment and Unemployment*, a series of current reports, mimeographed, published by the Economic Research Unit, Ministry of Labour, Jerusalem (Hebrew).

Secondly, new agricultural settlement. Farm units are planned on full development to provide settlers with full employment and a reasonable standard of living. However, none of the settlements founded since 1948 have yet received their full investment complement from the colonization agencies and in many of them there exists a grave problem of underemployment. Its magnitude has been conservatively estimated as the equivalent of about 10,000 man-days daily.[1]

Thirdly, there is widespread employment padding in manufacturing prompted in many cases by the sheer inability of managements, owing to Histadruth pressure, to lay off redundant labour. In lieu of non-available quantitative estimates in this field we will just quote one typical example which could readily be multiplied. Over a period of about 18 months from the beginning of 1955 to mid-1956 the Histadruth-owned and run Nesher cement plant in Haifa bay tried to lay off about 400 redundant employees, roughly half of its total labour force. After Herculean efforts it succeeded in ridding itself of less than 80, or 20 per cent., for the majority of which it had to assume continuing financial responsibility in the form of pre-dated pension payments.[2]

On the basis of the whole preceding discussion the total magnitude of economic unemployment in Israel in recent years may quite conservatively be put at 200,000 in round numbers. In terms of the paucity of economic job opportunities this reveals a short-fall of roughly 40 per cent. in the supply of economic jobs.

Israel's dominant labour force characteristics bear an uncanny affinity to those of the most opulent country in the world. America's low labour force participation rate and high concentration in the trade and services sector are rooted in the fabulous productivity of its economy. The question arises: What is the missing element in Israel's economic make-up which enables it to maintain even more extreme labour force characteristics? And the reply is that Israel's substitute for high domestic commodity production is the massive, continuous, and currently unrequited influx of foreign-manufactured goods, or the net import of capital, 99 per cent. of which consists of merchandise.

During the 9 years 1949–57 net capital import, i.e. the excess of the import over the export of goods and services, amounted to $2,766,800,000.[3] If we add to this the official estimate of $130 million[4] for May–December

[1] *Israel Agriculture 1953/54*, Joint Planning Centre for Agriculture and Colonization, and Economic Advisory Staff, 1955, p. 132.

[2] Hebrew daily *Haaretz*, 1955–6.

[3] S. Riemer, 'The Supply and Utilization of Capital Funds in the Israel Economy, 1948–1954', *Public Finance*, vol. xiii, no. 4, 1958, Holland, pp. 354–5; and *Annual Report, 1957*, Bank of Israel, Jerusalem, 1958, p. 26 (Hebrew).

[4] L. Eshkol, 'Capital Import and Its Countervalue in Defence, in Development and in Production', reprint from Hebrew daily *Davar*, Dec. 1957, p. 6.

1948 we reach a global total of about $2·9 billion for rather less than 10 years, or roughly $300 million per annum. About 22 per cent. of this sum was mobilized in the form of loans, so that by the end of 1957 Israel's foreign debt topped the $650 million mark.[1] Evaluated at calculated realistic exchange rates the import of capital added just 40 per cent. to the net national income produced at home during 1949–57. In the absence of capital import, i.e. the currently unrequited import of fuel oils, raw materials, semi-manufactures, investment goods, &c., the value of domestic output itself would of course have been much lower.

It is interesting to observe that the estimated short-fall of about 40 per cent. in the supply of economic jobs in Israel was nicely balanced by an addition of 40 per cent. to the domestic national income by way of capital import.

For the 9 years 1949–57 net capital import *per caput* of the Jewish population of Israel averaged $219 per annum. This may be compared with a U.N. estimate according to which about two-thirds of all humanity subsist at a level of less than $200 *per caput* per annum.[2]

At an earlier stage of the analysis, net investment in the economy for 1949–57 was estimated at $1,925,000,000. During the same 9-year timespan the net import of capital amounted to $2,766,800,00. It follows that national dis-saving, the excess of consumption over production, exceeded $800,000,000. This estimate should be treated with great care.

On one hand investments as here defined include not only all the public works schemes, which were primarily concerned with creating additional work-days rather than additional economic values, but also the huge volume of private luxury residential construction which was socially largely inessential and really amounted to the provision of durable consumption goods to the (primarily old-established) population. Finally investment costs were in many cases excessive, particularly as regards speculative housing construction and certain mammoth public projects such as the rehabilitation of the Dead Sea Works, the copper-extraction plant at the King Solomon Mines, &c. It is pretty certain that in terms of international values the new capital assets brought into being by the aggregate investment effort were nowhere near worth $2 billion.

On the other hand residual consumption as here calculated includes in addition to all defence expenditure, which must be regarded in the case of Israel as an essential social investment, also the considerable funds expended on the provision of public health and educational services, which are important and even productive investments for a community.

[1] *Annual Report, 1957*, Bank of Israel, Jerusalem, 1958, p. 41 (Hebrew).

[2] *National and Per Capita Incomes, Seventy Countries—1949*, United Nations, Statistical Papers, Series E, No. 1, New York, 1950, p. 29.

We must now review some of the outstanding characteristics of new investment in Israel.

Owing to mass immigration residential construction on a large scale was a social necessity even after taking into account the 50,000-odd more or less inhabitable dwelling units which the departing Arabs had left behind. Over the nine years 1949–57 residential construction was the biggest single item of investment and accounted on an average for about 35 per cent.[1] of gross investment. But how much of this total was directly devoted to meeting the housing needs of new immigrants? In terms of square metres only about 38 per cent.[2] of all residential construction, between 1950 and 1957, was for immigrant housing. However, since immigrant housing is invariably the cheapest type of construction its share in terms of the value of real economic resources sunk into new dwellings is lower still. Thus for the 6 years 1952–7 the value of immigrant housing has been officially estimated at about 30 per cent.[3] only of total residential construction. Bearing in mind that a sizeable minority of new immigrants live in new dwellings other than immigrant dwellings, though non-new immigrants are also at times found occupying immigrant housing, we may venture the rough guess that certainly no more than half of all resources invested in residential construction since the founding of the State went directly towards alleviating the living-space plight of new immigrants. The remainder was devoted to improving the housing conditions of the old-settled population.

The operation of rent control, by which house rents were frozen at their 1939 level, led to two interesting developments: firstly, to a black market in dwelling space, the so-called key-money racket, which may be defined as a payment in return for transferring legal tenancy rights over rent-controlled dwelling space. Secondly, to residential construction for outright sale, rather than for rental, except for certain publicly-financed immigrant housing projects. At the onset of mass immigration all legally rent-controlled dwelling space in Israel was by definition in the hands of old-timers who could extort large payments, pure windfall gains to them, for making it over to new-comers. With these key-money receipts they then acquired new homes which unlike the former became their private property. Key-money receipts were one of the principal sources of finance of the speculative private building boom of the years 1949–52. There was a sort of rough justice in all this. For while the people affected *sold* their

[1] Dr. A. L. Gaathon, 'The National Income', *Encyclopadia Hebraica*, vol. vi, Palestine, 1956–7, Jerusalem-Tel-Aviv, pp. 737–8, supplemented by unpublished estimates of the same author, and *Annual Reports, 1955 and 1957*, Bank of Israel (Hebrew).

[2] Ministry of Finance, Progress Report on Utilization of Export-Import Bank Loan; and *Annual Report, 1955, 1957*, Bank of Israel.

[3] *Annual Report, 1955, 1957*, Bank of Israel.

rights to rent-controlled dwelling space at free market rates, they were made to *acquire* their new homes also at the exorbitant prices prevailing on the free market. The real astronomical profits which were made in those years flowed into the pockets of building-material importers, site-owners, contractors, and certain types of skilled (and scarce) building workers, in that sequence.

But what are we to think of old-settled residents who *sold* their rights to rent-controlled dwelling space in the *free inflated* market and then were allowed to *buy* new housing in the *controlled subsidized* market?

The single most notorious instance of this kind was the Histadruth-sponsored old-residents housing project (the so-called Shikun Vatikim) which was built during the years of mass immigration 1950–1.[1] Eligibility in it was determined by a point-system based on length of dues-paying membership in the Histadruth, date of immigration, and family status. New immigrants were therefore by definition excluded. Altogether about 8,500 dwellings were put up under this scheme, apart from another odd 3,000 units in Kibbutzim (agricultural collective settlements) which do not concern us here. Government support assumed three principal forms: the provision of building sites, the allocation of building materials such as cement, iron, wood, &c., at officially controlled prices at a time when corresponding free or black-market prices were without exception several times higher, and finally a mortgage of £I 500 per housing unit. The price of a two-room standard flat to the owner-occupier came to £I 1,050–£I 1,300. Comparable accommodation on the free market must have been at least three times dearer. Key-money rates, current at the time, equalled roughly £I 1,000 per room (varying of course with neighbourhood, quality, &c.) and was usually distributed between departing tenant and landlord in the ratio of two to one. The share of key-money accruing to a tenant for selling his rights to legal rent-controlled dwelling space over one room only was therefore more than enough to make the cash payment on account of acquiring outright ownership over a two-roomed flat.

The doubling of real wage rates required, all other things being equal, a corresponding doubling of marginal labour productivity to make possible the continuation of economic employment. To facilitate this process government lavishly subsidized new capital acquisitions in at least three principal different ways: firstly, by allocating foreign exchange for the import of capital equipment at low exchange rates, over-valuing the Israel pound. This was particularly important during the first years until the far-reaching devaluations of 1952–4, but even today the official exchange

[1] Ch. Darin, *Housing and Absorption in Israel, 1947/48–1954/55*, Tel-Aviv, 1954–5, pp. 85–96 (Hebrew).

rate of £I 1·800–$1·00 contains a considerable over-valuation. At the end of 1951 a dollar's-worth of imported capital equipment was worth only about one-tenth of the cost of a day's local labour-power. Secondly, by making available loans for long periods and at low interest rates mainly out of the Development Budget. Thirdly, by requiring the repayment of principal and interest on these loans in nominal local currency values at a time when the real purchasing power of that currency was in a process of rapid erosion. (Since 1955 many Development Budget loans have a stable value clause attached to them by which repayment of principal and interest is to a certain extent linked to the cost-of-living index or the official exchange rate.)

The overall magnitude of this subsidization of capital can be highlighted by a simple example. Suppose a manufacturer received in 1950 a government loan for the acquisition of one million dollars' worth of equipment from America financed out of the Export-Import bank loan to the Israel Government. For the equivalent in local currency, about £I 357,000 at the then official exchange rate of £I 1·000–$2·80, he was then given a loan by government bearing, say, 5 per cent. interest, repayable in ten equal annual instalments. Half-way through the repayment period, in 1955, a million dollars are worth at the official exchange rate £I 1,800,000, or five times more, while £I 357,000 in 1955 are worth only about £I 135,000 in terms of 1950 prices, or less than 40 per cent. of its original value. Finally, the free market price of loans would be about 150–200 per cent. higher than the 5 per cent. charged by government. It follows that the manufacturer is paying for only a small fraction of the real economic value of the capital goods he acquired.

The upshot of this development was that excessively high labour costs in the economy were matched by no less excessively low capital costs. The latter may be represented in economic terms as the crystallization of labour-power in predominantly imported capital equipment, so that the whole arrangement amounts in the final analysis to a thinly veiled attempt to subsidize high-cost domestic labour power by low-cost foreign labour power.

And so it came about that domestic labour power, Israel's most abundant factor of production, was boosted into its most expensive productive input, while capital, and more particularly imported capital equipment, Israel's scarcest economic resource, became the country's cheapest factor of production.

Given this operative framework of relative prices, an irresistible tendency was unleashed everywhere for the continuous wholesale replacement of domestic labour power by imported capital equipment. In view of the mass immigration of the period there never existed the remotest chance of

achieving throughout the economy that excessive capital–labour input ratio which was dictated by their relative prices. Those who had easy access to capital and official foreign currency allocations equipped their enterprises with all the latest, up-to-date, mechanical and labour-saving devices, while the rest of the economy was left denuded of capital. In this way there developed in Israel a sort of lop-sided economy where small but superbly-equipped and labour-sparse manufacturing, agricultural, transport, &c., sectors coexist with a huge pool of (mainly new immigrant) labour power for whom no similar highly capital-intensive investments are available, and who in their absence, given ruling ruthlessly enforced official wage rates, are condemned to economic unemployment. These of course are none other than the 200,000-odd submerged breadwinners of Israel whom our previous analysis of labour-force characteristics brought to the light of day.

In the field of manufacturing, the single biggest goods-producing branch of the economy employing hired labour, the quest for higher capital intensity assumed two related forms: the tendency to replace men by machines, wherever the labour–capital input ratio was given to change, such as in the baking, food-processing, textile, &c., industries, and the tendency to push new investments increasingly into those fields which by their very (technological) nature are capital-intensive and labour-sparse, like the paper, basic chemicals, artificial fibres, &c., industries.

It has been estimated that in 1954 every production worker engaged in manufacturing in Israel had on an average 3·8 H.P. of machine power at his disposal.[1] This is about half the rate for the U.S.A. (8 H.P.), roughly equal to Great Britain (3–4 H.P.), and considerably in excess of the remainder of Western Europe (estimated at about 2–3 H.P.).

In six enterprises established in recent years, two each in plywood and tires and one each in paper and cement, investment in fixed production facilities has been estimated at £I 22,000 or $12,300 *per caput* of the total employed labour force. In ten additional projected investments in various stages of construction, estimated total *per caput* investment comes to nearly £I 42,000 or over $23,000. Total investment in the highly controversial integrated iron and steel mill which a Histadruth concern is putting up has been calculated by an international expert[2] at £I 120 million and employment at 1,500 persons, yielding a *per caput* investment of £I 80,000 or $44,000. (The Histadruth sponsors themselves put *per caput* investment at only a little above half that rate.)

The drive for highly capital-intensive investments has found its fullest,

[1] A. Gilath, *Economic Quarterly*, No. 8, June 1955 (Hebrew).

[2] E. Erdreich, consultant to the Ministry of Trade and Industry. His findings embodied in a mimeographed report were given wide publicity in Israel at the time.

and therefore absurdest, expression in the shipping investment program financed with German reparation funds.[1] The whole programme visualizes the acquisition of 48 ships—passenger vessels, cargo carriers, oil tankers, &c., with a total displacement of over 500,000 dead-weight tons at a cost of DM 513,000,000 or $122,000,000. Total investment will be of course considerably higher again by the inclusion of working capital calculated as the equivalent of the cost of operating the ships at sea for a certain period. This colossal investment will provide roughly 2,300 new jobs in terms of additional crew members, so that we get a *per caput* investment of about $63,000, calculated on fixed investment only. Until the end of 1957 18 ships with a dead-weight tonnage of over 150,000 and a value of over $40 million had already been delivered. The remainder are either under construction in German ship-yards or firm contracts have been placed for them, and all are scheduled to be commissioned until 1963.

The principal reason adduced for this shipping expansion programme is the claim that it is economically profitable. This of course is exactly what we have been driving at, that economic employment continues to be possible only under conditions of excessively capital-intensive investments, such as shipping. But recently grave doubts have been raised as to whether even with the ultra-modern equipment placed at their disposal Israel shipping lines will be able to make ends meet, and that because of excessive labour costs. It has been authoritatively calculated[2] that total labour costs, cash wages plus social charges, for operating a standard 4,000-ton cargo vessel are higher in Israel by 53 per cent., 60 per cent., and 80 per cent. than in Holland, Denmark, and Western Germany respectively. For a 10,000-ton freighter total labour costs in Israel exceed those in Sweden by 57 per cent., in Great Britain by 70 per cent., in Norway by 73 per cent., and in Greece by almost 90 per cent. (all evaluated at official exchange rates).

In the shipping boom following the Suez crisis even Israel lines could pay their way. Now that rates have dropped again to more normal levels, the local shipping companies are demanding from the government premium payments of 860 prutah or 47 per cent. above the official exchange rate of £I 1·800–$1·00, for every dollar saved or earned, in order to stay in business.

The shipping investment program testifies, in addition to what has been said above, to a bedevilling paucity of economically worth-while investment projects in Israel, prompted once more by excessive local labour costs, and this despite continuing immigration, incessant inflationary pressure, and a yawning precariously-financed trade deficit. Since the

[1] Information kindly supplied by the Shipping Dept., Ministry of Transport.
[2] By the two principal Israel shipping companies, quoted by the Hebrew daily *Haaretz*.

German reparations have to be spent on the acquisition of German goods and services within a stipulated time-period and since other investment projects are not forthcoming, funds are pushed willy-nilly into the acquisition of more ships. The only good thing that can be said about ships is that they represent a comparatively liquid form of investment that can be liquidated in the hour of dire need with less loss than most other physical capital assets.

In agriculture there is comparatively little employment of hired labour, apart from citri-culture, but excessive wages have left their bold imprint in this field too. National agricultural planning is for ever torn between two opposing policy goals. On one hand the level of wages prevailing in the towns inevitably sets the target for comparable living standards to be aimed at on the land which in turn requires high labour productivity on the farms. This may be called the efficiency-orientation of agricultural policy. On the other hand one of the ways of dealing with (and concealing) the unemployment which by definition results from the maintenance of excessive wages is to load a maximum number of people on to the land. This may be alluded to as the employment-orientation of agricultural policy.

Out of the need to reconcile these two conflicting objectives there has emerged an agriculture in which highly intensive cultivation is carried on with highly capital-intensive methods on small plots of land within a framework of all-pervasive subsidies.

Farmsteads usually do not exceed 30 dunam in size (7·5 acres) per family unit. To get the most out of them in terms of produce and employment, irrigation has been pushed at a very rapid pace. It has been estimated that irrigated cropland yields fourteen times more productive employment than unirrigated cropland, 12·9 as against only 0·92 man-days per dunam per annum.[1] Because of natural conditions irrigation water in Israel would in any case be expensive. But as the result of an irrigation development that has placed a premium on the costliest, most lavish, capital-intensive and labour-saving installations and methods, the average price of irrigation water in Israel is about four times the maximum amount that farmers in other countries have in similar circumstances found possible to pay.[2] It has been estimated that farmers will be able to defray no more than 10–25 per cent. of the real capital cost of already constructed and projected central irrigation systems.[3]

[1] *Israel Agriculture 1953/54*, Joint Planning Centre for Agriculture and Colonization, and Economic Advisory Staff, 1955, p. 133.

[2] Marion Clawson, 'Address to Farmers' Federation, July 1954', mimeographed; this sets out in summary form his conclusions, about Israel agriculture, which are based on a series of studies by the same author for the Economic Advisory Staff.

[3] Ibid.

Concerning the capital intensity of investments in agriculture we have already had occasion to draw attention to the doubling of planned investment outlays per farming unit since 1948. During the 6 years 1947–8 to 1953–4 (October through September) it has been estimated[1] that while labour input in agriculture roughly doubled, from 7 to 13·8 million man-days, the number of caterpillar tractors increased threefold (from 400 to 1,545), combines by 350 per cent. (from 260 to 1,175), and wheel tractors by no less than 560 per cent. (from 200 to 1,870).

Following the disappearance of cheap Arab labour in 1948, citriculture, Israel's main export line, has been completely revolutionized. Annual labour input per dunam of orange grove, apart from picking, has dropped from 16 man-days according to the old system of hand-labour to 2·5 man-days under full mechanization. An incidental by-product of this development has been a perceptible decline in the net foreign currency earnings of citrus exports due to higher depreciation charges on account of imported capital equipment.

The final reconciliation between the twin aims of dense agricultural settlement at comparatively high living standards was effected by subsidization in its manifold guises.

One of the ways of raising farm earnings is by increasing the farmers' share of total net value added created on the farm. This is done by reducing the return to other productive inputs such as land, capital, and irrigation water.

Most agricultural land in Israel is owned by the Jewish National Fund and is 'the inviolable property of the Jewish people'. It is leased to farmers for 49 years at a time. The standard land rent, reached on an ascending scale 6 years after settlement, is £I 28·800 annually per farm holding, irrespective of size. Since average farms come to about 28–30 dunam this works out at just £I 1·000 per dunam per year, which cannot be regarded as more than a token payment.

The capital of £I 25,000–£I 35,000[2] per farm holding is advanced to the settler in the form of a long-term loan bearing 3½ per cent. interest and repayable over 40 years *after* full development of the farm. None of the settlements founded since 1948 have yet begun (1958) payment on account of either principal or interest. First payments are scheduled for 1960 so that if all goes well the final annual instalment will fall due in the year 2000. Repayment is in nominal values, but for loans advanced prior to 1952 a 50 per cent. addition has been decided upon in principle.

There is wide agreement among local observers that farmers generally

[1] Ibid.

[2] *Planned Colonization Outlays*, mimeographed booklet published by the Jewish Agency Colonization Dept., 1957, Jerusalem (Hebrew).

do not pay the full economic cost of irrigation water, inclusive of both current operating costs and amortization of plant, but no reliable estimates are at hand as to the amount of subsidy concealed in irrigation-water prices.

As a result of the above price policies the farmer in Israel appropriates for himself as return for his labour, management, and risk-taking about two thirds of all net value added on his farm as against an estimated 45 per cent. only in America[1] (but the two percentages may not be fully comparable).

The differences between actual prices charged for land, capital, and water and their full prices in a free market economy amount to a concealed subsidization of agriculture.

Beyond this there are the more or less open agricultural subsidies which fall into three broad groups: specially high exchange rates to encourage exports of farm products, including citrus fruit, specially low exchange rates for the import of feeding stuff and fertilizers, and price subsidies on locally produced foods to stabilize the cost-of-living index. For the 2 years 1954–6 these open subsidies totalled £I 45,000,000, or about 6 per cent. of agricultural output.[2]

Finally, part of the (new immigrant) farm population is kept on the land through public works schemes of little or no productive value. For the financial year 1956–7, 350,000 man-days were allocated for that purpose.

An indication of the precipitate rise of living standards which has occurred since 1948 can be conveyed by a number of *ad hoc* indices. Housing density in Tel-Aviv dropped from an average of 3·08[3] persons per room at end-1946 to 1·7[4] persons per room in 1957, an improvement of about 40 per cent. The consumption of gas for household purposes, which broadly speaking reflects the spreading ownership of gas cooking and heating appliances, increased during 1951–7 from 1·5 to 8·8[5] kg. per annum *per caput* of the Jewish population. The number of refrigerators in the country increased, according to reliable estimate, from about 45,000 in 1951 to roughly 170,000 in 1958. At the latter date, after exclusion of bachelors and collective settlements, every second Jewish household in the country owned a refrigerator. The number of privately-owned passenger cars, motor-cycles, and motor-scooters has risen by leaps and bounds in recent years, but for some mysterious reason the publication of data on

[1] *Israel Agriculture, 1953/54*, p. 204.

[2] A. G. Black, 'Reflections upon Israel's Recent Agricultural Development and its Relationship to General Development', in 'The Challenge of Development', a symposium held in Jerusalem 26–27 June, 1957, The Hebrew University, Jerusalem, 1958, p. 201.

[3] Ch. Darin, *Housing in Israel*, p. 28, quoting a housing survey of the Jewish Agency Economic Research Institute. (This is an English version of his book in Hebrew.)

[4] *Statistical Abstract of Israel*, No. 10, 1958–9, Central Bureau of Statistics, Jerusalem.

[5] Fuel Dept., Ministry of Finance, Jerusalem.

registered vehicles in the country was discontinued in early 1955. All the above measures relate to the total Jewish population of the country and conceal wide differences between the new immigrant and old-established population segments. If it were possible to isolate the latter only the resulting rates of increase would be much higher again.

According to two basic consumption studies[1] conducted in 1950–1 and 1956–7 respectively, total expenditure of urban Jewish working-class families increased from £I 84 to £I 294 per month, or by 250 per cent. The cost-of-living index rose over the same time from 90·5 to 254 points (September 1951 = 100) or by 180 per cent. only, so that the real value expenditure grew by 25 per cent. Changes in different items of food of expenditure are very instructive. Thus, while consumption of standard brown bread dropped by 49 per cent., from 187 to 99 grammes *per caput* daily, that of white bread rose by 70 per cent., from 103 to 175 grammes. Consumption of meat increased by 28 per cent., while that of fish dropped by 62 per cent. The consumption of poultry nearly trebled, from 15 to 42 grammes per person daily, and the consumption of fresh eggs rose by almost 50 per cent.

The broad structural outline of the Israel economy which emerges from the whole preceding analysis can be summed up in the following terms: the changes which occurred in the market for labour since 1948 have resulted in the crystallization of an excessive wage level which in turn has given rise to two basic disequilibria in the economy, viz.

1. An internal disequilibrium between the demand and supply of economic job opportunities, or the inability to maintain full economic employment.
2. An external disequilibrium between the demand and (autonomous) supply of foreign currency, or the inability to balance the country's international transactions out of its own resources.

The three aspects of the situation, i.e. wages, employment, and capital import, are intimately and organically related to one another. The import of capital makes possible the maintenance of excessive wages, principally by providing the means of subsistence for that segment of the population which is thereby denied economic employment. The paucity of economic job opportunities in turn is the principal cause why the country's trade deficit cannot be reduced or bridged: firstly, because domestic production cannot be expanded sufficiently to increase exports and to replace imports, and secondly, because capital imports themselves cannot be fully utilized for productive investment. And so the circle is complete, the trap

[1] By the Central Bureau of Statistics, for revisions of the cost-of-living index. The following data were taken from its *Monthly Statistical Bulletin*, vol. ix, p. 203, English summary.

closed: the current trade and services deficit makes possible excessive wages, and excessive wages make it impossible to attain viable economic independence.

The extent and intensity of the economy's two basic disequilibria can be varied inversely. The internal employment disequilibrium can be alleviated at the expense of a worsening in the external payments disequilibrium, and vice versa. The lever or instrument for switching the economy relatively from one disequilibrium to the other is monetary policy. By expanding the money supply in real value terms the internal employment position is improved and the external payments position is worsened, while a contraction of the real money supply leads to a deterioration of domestic employment and an improvement in the international balance of payments.

Until 1952 monetary forces were not allowed to function freely in the economy. The money supply was rapidly expanded by government deficit finance at the same time that the official price level was pushed down (during part of the period) by administrative decrees. In the end violent inner contradictions, deriving principally from the inability to syphon off excessive purchasing power from the market, forced the government to terminate this unhappy experiment in suppressed inflation.

With the introduction of the New Economic Policy (NEP) in early 1952 and the gradual return of the economy to the discipline of the price mechanism, monetary policy came into its own as the gear-box for switching the economy between internal and external disequilibrium. During the 18 months from January 1952 to mid-1953, the nominal money supply expanded by only 16 per cent., while the price level shot up by 74 per cent., so that the real money supply, in terms of the price level, contracted by over a third.[1] As a result the internal employment disequilibrium worsened and the external payments disequilibrium improved. Unfortunately the only current available unemployment data are the registrations at the labour exchanges, which are quite meaningless in themselves but will be used here, in lieu of anything better, as an indicator of *relative* change. Thus during the 2 years 1951–3 average daily unemployment registrations increased by 180 per cent. (from 6,300 to 17,700).[2] During the same time-span the current trade and services deficit contracted by almost 30 per cent. (from $371 million in 1951 to $263 million in 1953).

Towards the end of 1953 the government authorized the expansion of the money supply and the pendulum swung into the opposite direction. In 1954 the real money supply grew by 11 per cent. and in 1955 by another

[1] *Monthly Statistical Bulletins* of Israel, Central Bureau of Statistics (Hebrew).
[2] Ibid.

15 per cent. Accordingly registered unemployment dropped, by 25 per cent. during 1954 and by another 18 per cent. in 1955. However, contrary to our postulated theoretical framework the foreign payments deficit in 1954 shrank too, by $22 million to only $241 million. This was principally due to the introduction of the £I 1·800–$1·00 exchange rate during the second half of 1953 which boosted exports in 1954 by a third. But already in 1955 the export incentive effect of the new exchange rate had largely spent itself, owing to the attrition of the domestic price level, so that exports remained virtually stationary, while imports bounded up in the wake of the real money supply expansion, so that the foreign trade and services deficit in 1955 widened by 17·4 per cent. to $283 million.

The Sinai campaign and the preparations for it dominated 1956. The real money supply expanded by another 18 per cent., official unemployment registrations remained low, and the deficit on current account in the country's international balance of payments grew by over a fourth to reach $356 million. In 1957 the real money supply rose by less than 6 per cent., official unemployment stayed low, and the trade and services deficit contracted somewhat to $337 million. However, after exclusion of government services the current deficit shows an increase from $267 to $299 million during 1956–7.[1]

Over the last few years, excepting 1955, there has occurred a heartening expansion in the value and volume of Israel exports under the incentive of special export premiums. But imports grew by no less. While therefore total exports, visible and invisible, account for a growing share of total imports (from about 13 per cent. in 1951 to nearly 40 per cent. in 1957), the decisive absolute gap between total imports and exports shows no sign of closing and is even widening.

Inflationary pressures which have been rampant in the economy over the last 10 years have raised the internal price level by a multiple of roughly three and have reduced the official foreign exchange value of the national currency to rather less than one-fifth.

The nearest the government has ever come to taking action against the continuous rise of wages is by the manipulation of the cost-of-living index. Since wages are linked to the cost of living via quasi-automatic cost-of-living allowances, manipulation of the index can slow down the growth of wages. This is done by a judicious mixture of price controls, token rationing, consumers' subsidies, exemption from purchase tax, and related measures, all limited to 'basket' items having high weights. These selective controls are usually activated for short intervals only to push the index down at certain determining dates for the periodical revision of cost-of-living allowances, so that the movement of the cost-of-living index

[1] *Annual Report, 1957*, Bank of Israel, Jerusalem, 1958, p. 25 (Hebrew).

over the last few years exemplifies a wild zigzag pattern. The preoccupation of economic policy with the cost-of-living index has at times led to unfortunate results. Milk and eggs, for instance, are heavily subsidized because of their importance in the cost-of-living index and their consumption is accordingly quite artificially boosted. But the domestic production of milk and eggs contains a heavy foreign currency component and should therefore be discouraged in favour of, say, industrial crops.

Nor must we forget the cost of subsidies in terms of foregone development, security, social services, &c. During the financial year April 1957 to March 1958 the government spent £I 69·1[1] million or 11 per cent. of all current expenditure on subsidies.

Usually, however, government economic policy has been concerned less with thwarting the upward thrust of wages than with trying to make good their adverse impact on the economy as and when it makes itself felt.

Export premiums are such a measure, designed to improve the country's international balance of payments position. In the final analysis export premiums on net foreign currency earnings are a device for reducing the *dollar* wage to exporters while not reducing the *real* wage to workers, with government bearing the difference. The trouble with export premiums is that they have a way of growing all the time. In 1953–4 the new exchange rate of £I 1·800–$1·00 was considered a *premium* rate, while today in 1958 a rate of £I 2·650–$1·00 is no longer capable of stimulating exports. During the financial year 1957–8 the government spent £I 31·4[2] million on export premiums, apart from another £I 14[3] million premium payments to local citizens on the transfer of capital. If we add the aforementioned internal subsidies, we reach a grand total of £I 114·5[4] million spent by the government on open subsidies which equals 18 per cent. of all its ordinary expenditure. Export premiums may serve a useful purpose as an interim, stop-gap palliative, but no more.

As export premiums to the external payments balance, so savings to internal employment. If excessive incomes cannot be directly reduced then as a second best it would help if people could be induced to abstain from currently consuming them all. This affects employment favourably in at least two related ways: firstly, the funds so saved can be applied to subsidize employment elsewhere without causing inflationary pressure; secondly, more resources can be diverted from current consumption to new (productive) investment and in this way once again increase employment opportunities. Until 1955 the principal source of savings in the economy were provident and social insurance funds, with government

[1] Financial Accounts, Government of Israel, Ministry of Finance, 1958, Jerusalem (Hebrew).
[2] Ibid. [3] Ibid. [4] Ibid.

forced savings and life insurance netting smaller sums.[1] Savings generally were discouraged by the continuous erosion of the real purchasing power of the currency. To overcome this drawback constant value clauses were introduced in 1955 by which the nominal value of savings is linked to changes in the cost-of-living index, the official exchange rate, the price of dwellings, orange groves, &c. In this way the savings movement in Israel received a powerful fillip. Until the end of 1957 about £I 125[2] million of value-linked debentures had been taken up. Personal savings have been estimated at £I 62·2[3] million and £I 110[4] million in 1956 and 1957 respectively (about 3 per cent. and 4 per cent. of the national income). The reappearance of savings in Israel is a very welcome development that is no doubt destined to play its part in putting the economy on its feet. But it would be foolhardy to assume that savings can ever be an effective substitute for a sane wages policy on the employment front.

In certain quarters the very original argument is sometimes advanced that while wages may be excessive in our defined sense, there is no need to reduce them but productivity should be raised instead. This is surely putting the cart before the horse. If it is true that economics is rooted in scarcity and concerned ultimately with the optimal allocation of limited means among unlimited competing ends, then every advance of productivity is really a step towards overcoming objective scarcity. To settle the wages issue by appealing to an increase of productivity is therefore solving an economic problem by doing away with the limitations of economics altogether. This is just wishful thinking. Productivity, so far from being a policy means, is really, in the final analysis, the be-all and end-all of all economic endeavour. The pursuance of correct economic policies, including wages policy, may in the fullness of time lead to a general advance of productivity and therefore of living standards, but productivity cannot be evoked as a sort of magic wand or panacea for economic ills, to justify any old silly policy. Otherwise it is really very difficult to understand why all the peoples of the world, including those of the U.S.A., should ever be content with the wage levels and living standards they have achieved if they could raise them by sleight of hand and then decree an offsetting increase of productivity. It is like advising a general on the field of battle to win the war by breaking the resistance of the enemy. So much he knows himself! What he might like to know is what tactics and strategy to employ in order to attain the avowed end. Similarly economic policy-makers need not be told to aim at raising productivity but rather how best to do so.

[1] S. Riemer, 'The Supply and Utilization of Capital Funds in the Israel Economy, 1948–1954', *Public Finance*, vol. xiii, No. 4, 1958, Holland, particularly table 7, p. 363.

[2] *Annual Report, 1958*, Bank of Israel, Jerusalem, 1959, p. 292.

[3] *Annual Report, 1956*, Bank of Israel, Jerusalem, 1957, p. 314.

[4] *Annual Report, 1957*, Bank of Israel, Jerusalem, 1958, p. 202.

The government Productivity Institute set up several years ago has done useful work in spreading the gospel of productivity among producers and in generally making the people more productivity-conscious. But no amount of illustrated booklets and pep-talks by foreign experts on productivity are going to spirit out of existence Israel's grave wages problem. It should also be noted that while Histadruth leaders display unflagging enthusiasm about raising productivity they get very wary and downright obstructive when it comes to endorsing efficiency dismissals—which in many cases are no more than a natural by-product of increased productivity.

Finally there is economic planning. Its rationale seems to be that while wages are taboo and must not be touched, economic planning will, somehow or other, make it possible to get round the awkward problems they pose and make good their adverse impact on the national economic life. One of the results has been detailed physical planning of new investments which really amounts to an attempt on the part of government departments to take over the entrepreneurial functions in the economy. This was foredoomed to failure. Nobody will deny that government has important planning functions to fulfil. As the principal source of investment capital in the economy, the government must plan its own autonomous development activities wherever private capital and initiative are not forthcoming, and it has also a legitimate right to evaluate such investment projects as are submitted to it for approval and financial assistance. But beyond these limits the government's primary function and responsibility in the sort of mixed economy that exists in Israel is for planning the broad economic conditions that will make it possible to harness individual self-interest to the common good, and for devising an operative economic framework within which the exercise of legitimate economic initiative, acumen, and daring will be given the fullest possible scope. But that would mean, among other things, and maybe above all, a searching and painful reappraisal of the national wages policy which the resounding slogans of economic planning are primarily designed to side-step and circumvent.

When all is said and done, the only way of dealing effectively with the problem of excessive wages in the Israel economy is to take the bull firmly by the horns and operate on the level of prevailing wages.

When I first came to Israel in 1949 I was struck by the existence of quasi-universal, quasi-automatic, cost-of-living allowances. These had been evolved during the Second World War to protect wage and salary earners against inflation. It occurred to me that in the radically changed circumstances of independent statehood and mass immigration the same institutional device could be made the vehicle for bringing about a requisite downward adjustment of wages as the workers' contribution, the only

one that makes economic sense, for facilitating the economic absorption of their new immigrant brethren. Accordingly I suggested linking cost-of-living allowances inversely to volume of immigration in addition to continuing the direct link with the cost-of-living index.[1] On the basis of a given set of assumptions I worked out a scheme by which in return for every 720 new immigrants workers would be asked to forgo in terms of wages the equivalent of two points in the cost-of-living index for a period of 6 months. Self-employed people would make a corresponding contribution by way of compulsory loans or capital levies. The details were never of importance; what mattered was the principle.

A second suggestion would have severed the link between wages and prices by abolishing cost-of-living allowances.[2] By then freezing nominal wages while allowing the price level to rise through devaluation, the required reduction of real wages could be effected.

A third proposal accepted in principle the social philosophy in which cost-of-living allowances are rooted but sought to bring their working in line with economic reality. It was suggested to replace, for purposes of cost-of-living allowance computation, the present comprehensive cost-of-living index by a cost-of-subsistence index based on an iron ration composed of biological necessities only.[3] All citizens willing and able to work would in this way be prevented from falling beneath a clearly defined minimum subsistence level. By effectively banishing real physical want the State would amply fulfil its social welfare obligations at that level of social achievement that is commensurate with its economic potential.

A standard argument against tampering with or abolishing cost-of-living allowances is that the resulting loss of real income of the workers would accrue as additional profits to the employers. This may be called an economic optical illusion. Wages are fixed ahead of time and therefore can be changed directly at will, while profits are a residual income that remains at the end of the productive process as the difference between production costs and market price. To keep profit margins at a minimum, market prices must be held as near as possible above production costs. In a free market economy this is achieved by a combination of monetary policy (preventing demand inflation), fiscal policy (above all high and efficient income taxation), the prevention of unfair practices in restraint of trade (anti-cartel legislation), and public control, not excluding outright ownership, of so-called natural monopolies. The growing cartellization of the

[1] S. Riemer, 'An Economic Policy for Israel', memo. to Finance Minister, Dec. 1949.

[2] S. Riemer, *The Israel Economy: Problem and Solution*, booklet, Beterem–Tel-Aviv, 1953 (Hebrew).

[3] This idea was worked out by me in some detail in a series of memoranda for the Economic Advisory Staff, 1954.

Israel economy in recent years really amounts to the equivalent of automatic cost-of-living allowances for the benefit of employers. Government has over the past 5 years worked on an anti-cartel law but nothing has come of it to date.[1] It is claimed that the Histadruth objects to the application of some of the provisions of the law to its own formidable economic sector. If that is true, the Histadruth is holding up economic progress on both sides of the barricades: on the issue of wage levels and cost-of-living allowances through its trade union department and on the problem of competitive freedom and efficiency by the pressure exerted by its powerful technocracy.

However, economic argument cuts little ice with people in Israel (they might think it a good debating-point but no more), and the deeply ingrained feeling that a loss of wages automatically means an increase of profits is still widely held. In deference to this superstition I have tried over the past year to work out a system which, while reducing real wages, would at the same time provide iron-clad, fool-proof, institutional assurances that profits would go down by a like degree.[2] The essence of the scheme can be put in two simple words: profit sharing. At a given deadline date cost-of-living allowances would be suspended and wages frozen at the level then obtaining. Any rise in the general price level would then be the equivalent of a corresponding diminution of real wages. After the end of the year, or any other convenient time-period, profits in excess of profits in the base period would be shared out with the workers according to a given, previously agreed upon, formula. Floors might be fixed beneath which real wages would not be allowed to drop, or profits have to be shared out. A possible criterion for the former would be minimum conventional needs and for the latter minimum ratios of profits to invested capital. Offhand I can think of many objections to the scheme, concerning loopholes which would prevent its equitable working, but I am convinced that given goodwill, human ingenuity in institutional engineering can overcome them all.

People like me in Israel are often accused of wanting to slash wages and reduce living standards as an end in itself, maybe for the sheer sadistic pleasure derived from grinding the workers' faces in the dust. Nothing could be farther from the truth. Speaking for myself I certainly want the attainment of the highest possible living standards for the workers and the general population of Israel. The real issue is not between raising and slashing living standards, but between a gradual and tolerable cut of living standards now to absorb the shock of shrinking capital imports in

[1] Some legislation was enacted in 1959.

[2] This idea was first put forward in an article in the Hebrew daily *Haboker*, in the summer of 1957.

the foreseeable future (i.e. at the latest after 1962 when the German reparations will give out) and a sudden and intolerable collapse of living standards at the latter contingency. The attenuated drop of living standards today would, by releasing additional funds for investment, help to equip the economy to stand on its own feet in the future, while the continuation of present or even higher living standards now will lead to the collapse not only of living standards but of the national economy as a whole, once large-scale foreign economic aid is cut off. Viewed, therefore, over this longer time-perspective surely the downward adjustment, by say a quarter to a third, of present wage levels and living standards will ultimately prove to have been consistent with the attainment of the highest (economically) possible living standards over the period as a whole.

Today Israel is politically independent (at least in a formal sense) but economically dependent. Once capital imports give out we shall be economically independent, willy-nilly. The crucial question is whether the economic independence will be viable or whether it will coincide with the loss of our hard-won political independence.

King's College, Cambridge

THE WORKING OF THE RADCLIFFE MONETARY SYSTEM

By A. E. JASAY

REAPPRAISAL of the 'working of the monetary system', after the eventful decades which elapsed since it was last appraised by the Macmillan Report, must have been an agonizing task for the authors of the Radcliffe Report. For their readiness to shoulder it they deserve respect, and for the factual details of the Report gratitude.

Nevertheless, reading it is as agonizing to the reader as writing it must have been to the authors. The agony of this reader springs from feeling thoroughly confused. On the one hand, most of the conclusions drawn by the Report are acceptable. Interest rates are not significant deterrents to spending (451)[1] or strong stimulants to saving (450), yet had better be kept fairly high (495); management of the national debt is important (603); obstruction of particular channels of finance has no effect on the pressure of total demand but makes for much inefficiency in financial organization (469); control of the sheer quantity of money is largely futile (504); monetary policy can help, but that is all (514). These major pronouncements on policy, one instinctively feels, must be broadly right. Post-war experience, at any rate, supports them better than their opposites. On the other hand, these very acceptable policy conclusions hang rather in the air. They seem to me independent of the reasoning of what I should, from now on, like to call the Radcliffe Theory of Employment, Interest, and Money.

Moreover, I for one find the Radcliffe Theory itself an utterly muddled one. Its bad logic cannot be explained by the exigencies of unanimity. It could not have been unduly difficult to think up and agree on a little more lucid theory in support of such quite modest conclusions about the unimportance of monetary policy. Failure to do so, and presentation of the Radcliffe Theory instead, is perhaps the worst count in the indictment against the Report—for its influence on policy is likely to be a great deal less lasting than on the habits of thought of generations of students.

Most theoretical muddles can be straightened out; perhaps the Radcliffe Theory is no exception. One wonders whether, with the inconsistencies and tautologies cleared away, the policy conclusions themselves need look so dispiriting. Accordingly this paper will attempt a two-stage task. The first stage, of course, is getting the theory straight and stopping up at least its more easily detectable loopholes. The second is reconciling the

[1] The figures in parentheses refer to paragraph numbers in the *Report of the Committee on the Working of the Monetary System*, H.M.S.O. 1959, Cmnd. 827.

Radcliffe Policy with the tightened-up theory, and in particular deciding whether the Radcliffe Theory, if accepted wholly or in part, really excludes a more ambitious view of the scope for monetary policy.

Sorting out Stocks and Flows

Repeatedly the Committee state that the volume of demand for goods and services is primarily influenced by the 'general level of liquidity' (and not by interest rates). At first sight the Radcliffe Theory appears sharply to swing away from Keynesian theory on just this point; in the Keynesian system, if there is any link between aggregate demand and 'liquidity', it is through the rate of interest. However, a departure from the Keynesian system would not alone make the Radcliffe Theory any poorer than it is. On the contrary, this particular break with Keynesianism might be salutary in turning our attention back towards neo-classical doctrines on the relation between the demand for money stocks and the demand for flows of goods and services.

This, however, may not be what the Committee have in mind; in fact, it is doubtful whether their theory really differs from the Keynesian one in this respect. For purposes of argument and without imputing to the Radcliffe Theory an actual confusion of stocks with flows, let us try out a line of reasoning which does involve such a confusion; we will, as we go, make sure of our conceptual mechanism for sorting out assets and liabilities from incomes and expenditures. Our starting proposition is in the following paragraph:

General liquidity is the quantity of financial assets, measured at their current prices, held in the private sector of the economy. (Whether this particular meaning of 'liquidity', one of the many others which can, with a little goodwill, be read into the Report, is acceptable does not matter at this stage. Liquidity is what liquidity does.) Aggregate demand is an increasing function of general liquidity (389). Aggregate demand increases when the quantity of financial assets increases.

Now the issue of additional financial assets *means* an increase in aggregate demand *if and because* the issuer wishes to make additional claims on goods and services. An addition to the stock of government securities outstanding *represents* an excess of the public sector's expenditure over its income. An increase in the deposit liabilities of hire-purchase finance companies is *a reflection* of additional claims made by the hire-purchase debtors on cars or radio sets. Demand for goods and services, in other words, has increased because it has increased. The increase in the stock of financial assets is not the cause but the symptom of this. (Nor is it a necessary symptom. Demand for current goods and services may increase without any change in the stock of financial assets if, *ceteris paribus*, some people who used to save much start to save only a little.)

The suspicion of an actual stock–flow muddle is aroused by the puzzling statement that 'self-finance through private savings or through the reinvestment of depreciation reserves and retained profits . . . contribute[s] to the liquidity position as a whole' (297). Surely this cannot be intended to mean that the greater the propensity to *save out of a given income*, the greater the (general liquidity and therefore) aggregate demand? If, as we must hope, it does not mean that, then it must presumably mean that the greater the *stock of past savings*, the greater the liquidity and hence demand. Past savings, of course, need not be held in the form of financial assets. Granting, however, that they are, the greater their stock, the greater will be the stock of financial assets and therefore general liquidity. But this extra quantity of financial assets is not an increase in the sense of our previous paragraph; it is not an excess supply-flow of monetary assets which must be absorbed *via* increasing money incomes all round, but a reflection of the arrangements of society in the matter of holding its real wealth, directly or through a superstructure of paper claims and counter-claims—arrangements which do not *imply* excess supply of money and securities and excess demand for goods and services.

If, however, the Radcliffe Theory does require some such implication, it can ensure it by postulating that, *ceteris paribus*, the more 'liquid' the institutional arrangements of society, i.e. (in the present context) the greater the stock of *financial* assets and liabilities piled on top of, and supported by, a given stock of *real* assets, the smaller will be current saving or the greater will be current investment out of a given real income. I am not myself altogether sure whether this interpretation accords with the authors' intention, but I cannot see any other way of shutting the door to the threat of a stock–flow muddle in their context.

So interpreted, the Radcliffe Theory does represent a clean break with the General Theory. It is reminiscent of the Old Cambridge or neo-classical theory where a greater quantity of money, to be held in the face of a given real income or wealth,[1] induces excess demand for goods and services which drives up prices until the relation of money stock and money income is no greater than it was before. The principal difference between the Old

[1] It is not always quite clear whether the Old Cambridge Theory means 'income' or 'wealth'. The Cambridge K is said to be the proportion of 'total *resources*, expressed in terms of wheat, that are enjoyed by the community' (Pigou, 'The Exchange Value of Legal Tender Money', *Essays in Applied Economics*, p. 177, my italics). Moreover, if 'wealth' is held to be some capitalized value of income, the distinction between the two becomes meaningless. On the other hand, price stability in neo-classical theory must depend on the community maintaining K between money income and the money value of wealth (including paper claims like money whose price does not vary with money income). This requires a distinction between wealth and income. However, putting the corresponding real-balance and real-indebtedness 'effects' into the Radcliffe Theory is an unrewarding experiment, because in the Radcliffe Economy the quantity of paper claims is not independently determined. In fact, as I shall argue, it is indeterminate.

Cambridge and the Radcliffe Theories is that where the former uses 'quantity of money', the latter insists on using 'general level of liquidity', more than once stressing that liquidity is not the same as money—whatever else it may be. To this 'whatever else' I now propose to turn.

The Liquidity Muddle

It may not be fair to expect the same rigour of definition and conceptual clarity in an official Report as in writings which can freely draw on an agreed and highly professional jargon. However, even after all due allowances, Radcliffe Liquidity is a considerable trial. The authors leave the reader rather too much freedom to interpret the concept in the way he likes. Nevertheless, there is something to be said for availing ourselves of it. By assigning alternative meanings or functions to 'liquidity' and experimenting with them, we should run up against, and detect, the restrictions on this freedom which must be concealed in the theory.

Two meanings seem to me superficially consonant with most and dissonant with fewest of the passages in the Report where 'liquidity', demand, inflation, and its control are related to each other. 'Liquidity' (or 'general level of liquidity') is either a *quantity* (e.g. 478), namely that of all financial assets relative to non-financial assets (aggregate net wealth) or to money income (so that when financial assets grow without net wealth or money income growing, we say that liquidity has increased)—or else it is a *quality* of assets (e.g. 373) (so that when a change in the composition of a given quantity of assets favours those possessing this quality, we say that liquidity has increased). The two meanings, of course, are not mutually exclusive. However, the latter merely throws the onus of definition farther back: '*a* quality' does not tell us *what* quality, and here again several interpretations could be tried out. At first, however, let us see where the first meaning, i.e. 'liquidity is the quantity of financial assets', appears to lead.

Financial assets (credits) are exactly matched by financial liabilities (debts). But this, as the Committee point out (299), need not mean that their economic effects exactly cancel out; they will not cancel out if there are significant asymmetries between the position or behaviour of lenders and borrowers. The obvious example is government securities, an asset to the private sector and a liability to the public sector whose behaviour is governed by very different laws. Less obvious but nevertheless real asymmetries may exist between the creditors and debtors of banks, or between trade creditors and trade debtors. There is thus nothing *prima facie* absurd in postulating that the sheer quantity of financial assets, despite some element of cancelling out, has some net economic effect. The effect—

the role, so to speak, which the Committee assign to 'general liquidity'—is on aggregate demand for goods and services. However, it is not altogether clear from the text how demand is supposed to be affected; though the precise identity of Radcliffe Liquidity is so shrouded in verbiage that we can, as it were, only recognize it by its deeds, we cannot even be sure what deeds to look for.

Two alternatives emerge from the Report. (*A*) General liquidity actually raises demand (increases the income-velocity of circulation of a given stock of money)—a *causative* influence. (*B*) General liquidity does not actually increase demand, but enables an increase, induced by autonomous factors, to materialize. (Liquidity is 'capacity', 'room' or 'potential' for a rise in the income-velocity of circulation to take place (392, footnote).) This is not a causative but a *permissive* influence. In either case the stock–flow muddle is already eliminated; what we are considering is not, to paraphrase Pigou, the 'consequence of a change' in the quantity of financial assets (with an increase in demand *preceding and causing* the issue of additional securities), but the 'implications of a difference' in the sense of comparing two states of the economy, the one with few and the other with many financial assets lying about.

It quickly turns out, however, that the Radcliffe theory obliges us to rule out (*B*); for the *B*-deeds of liquidity run up against restrictions built into the rest of the theory.

Evidently the alleged enabling role of liquidity springs from the need to 'finance' an increase in the rate of expenditure (over and above the rate of saving including, of course, profit retentions) by the transfer of assets. The assets concerned may be (i) pre-existing 'real' ones, (ii) pre-existing 'financial' ones, or (iii) newly issued 'financial' ones ('fresh borrowing'). For liquidity to perform its alleged *B*-deed, (ii) must be capable of something which (i) and (iii) are not. In the words of the Report, a decision to step up spending cannot be thwarted 'if the money is already there' (388).

Pre-existing financial assets may be superior to either existing real ones or to newly created ones *if* they can be transferred to somebody else without having to offer him too generous a bribe (i.e. if they can be sold, as it were, 'without significant loss'). Now whether they do have this superior property or not is, I think, itself a still unsolved question connected with the circular origins of the concept 'liquidity' (as a quality which certain assets possess in greater measure than others). But this question is irrelevant to our immediate purpose. For granting that old financial assets *are* transferable at a smaller sacrifice in price than either real assets or newly issued financial ones, their superiority would lie in thus reducing the interest cost of 'financing' the extra expenditure. But this cannot be the magic enabling effect of liquidity on demand, because one of the few explicit

restrictions built into the Radcliffe Theory is that demand is highly insensitive to interest.

Falling farther back in this simulated defence of liquidity's *B*-deed, one could say that it concerns not the easing of the terms on which money can be obtained, but the settling of the question whether it can be obtained at all, regardless of the terms (interest cost). If capital-issues control and an administrative ceiling on bank advances altogether prevent new borrowing (the creation of new financial assets), the would-be spender can obtain money only if he has old assets (financial or real) to dispose of. It is worth remembering, though, that in one of its many valuable judgements on matters of fact, the Committee stressed the uselessness of capital-issues control (362–4) and of other 'obstructions of particular channels of finance', and intimated that if there is a will to spend, a way will be found, for the financial markets are really a single whole (315–16).

If, however, we choose to be ultra-fair to the Radcliffe Theory and suppose that new borrowing can be physically prevented (which rules out (iii) assets, so that existing assets (i) and (ii) become the sole 'financing' medium), what is it that financial assets can do which is not a matter of the terms (cost) at which they do it?

In a market economy, both (i) and (ii) assets *can* be sold for money, and though one may fetch a worse price relative to some subjective valuation of the holder than another, this is, as we have seen, a matter of the interest cost of 'financing' and cannot, in terms of the Radcliffe Theory, be considered. Another trick, however, which at least some (ii)-type assets can do and (i)-type assets not, may be in the Committee's mind in this connexion. It takes us much too far from a market economy, but then it is sometimes doubtful whether the subject-matter of the Radcliffe Theory is a market economy at all. The trick is this: transferring assets by sale requires the taker's consent, while transferring them upon an obligation presupposes nobody's consent—it is a matter of honouring a debt contract. No court will force someone to take the would-be spender's *real* assets and to pay him money in exchange. But if he has *financial* assets, i.e. if he is owed money, he can insist on its repayment and that is the end of the matter.

Alas, however, even this curious let-out is closed to us by the theory itself. For at any point in time only those debt contracts (financial assets–liabilities) can be liquidated *at the creditor's option* which *are* mature, namely, somebody else's *sight liabilities*, or in other words bank deposits. Bank deposits are money. Other financial assets may be nearing maturity, i.e. approaching the money stage, and are certain to reach it either by virtue of a contractual maturity date (e.g. bills) or of the holder's power to give notice of withdrawal (e.g. hire-purchase or building society deposits,

certain mortgages). When, after the passage of a fixed period of time, they *have* become money, they can be used by the would-be spender without requiring another party's consent. The fact, however, remains that at any time the assets which can be so used (transferred without, as it were, asking the asset market's leave) *are* money. Their total stock is the quantity of money. But this, the Report tells us, is a largely irrelevant variable. In its climactic summing-up of the application of the Radcliffe Theory to the problem of how to control aggregate demand, it rejects 'from among such measures any restriction of the supply of money' and instead advocates 'measures which strike more directly and rapidly at the liquidity of spenders' (524). What, then, *is* this liquidity?

We were obliged to rule out both the conceivable 'enabling' or 'permissive' effects of 'liquidity', namely, that it enables would-be spenders to get hold of money on easier terms (*interest rate*) or without the market's leave and at their own sole option (*quantity of money*). The *B*-deeds of liquidity, according to the Radcliffe Theory, are irrelevant to demand. Moreover, whatever liquidity *as a quality* of assets may *be*, anything it might *do* must be some sort of *B*-deed—having to do either with the terms on which the asset can, with somebody's willing consent, be converted into money or money's worth *in* the asset market, or with the power of the asset to command money or money's worth, as it were, *outside* the asset market and without anybody's consent being required—yet *B*-deeds are immaterial. Therefore liquidity as a quality of assets will not significantly affect behaviour.

We must fall back on liquidity as a quantity and on its possible *A*-deed. Restating it: the quantity of financial assets–liabilities, to be known as liquidity, governs present demand. The greater the liquidity, the greater will be the demand for goods and services. This must be an assumption of the theory, and there can be no quarrel with it on grounds of logic. On grounds of realism, moreover, quarrel is futile, at least until the evidence collected by the Committee is published.[1]

How does this particular liquidity behave? It is created mainly by financial institutions among whom, it seems, we have for certain purposes to include all industrial and commercial firms who grant trade credit. Its most interesting feature, emerging from the Report, is that if there is a will there is a way for it to expand beyond any given level. Its second significant feature, also according to the Report, is that it can really only be controlled through the pattern of interest rates. This latter is a puzzling feature indeed in the light of what the same theory postulates about interest rates; however, let us defer looking at the puzzle till after we have dealt with the rubber-like expansibility of liquidity.

[1] This article was written in October 1959.

Financial assets can be created (issued) by incurring a financial liability; the asset so created is, as it were, 'backed' by the issuer's own net wealth. The private sector's own net wealth is coextensive with the privately owned stock of real capital and the public sector's financial liabilities (government securities including legal tender cash). For the stock of financial assets to be 'stretchable' like chewing gum, either the 'backing', or the ratio of financial assets–liabilities to the 'backing' available (the 'gearing'), or both, must be stretchable.

The backing of net wealth, however, is fixed in the short run; it only increases with real capital formation in the private sector, or with expansion of the national debt (including legal tender cash). Therefore, if the stock of financial assets can easily expand in the short run, the 'gearing' must freely vary. If it is constrained by anything other than legal or institutional rules, it is constrained by risk. If it can rise freely, risk is presumably deemed to be absent in any relevant range of the ratio. Lenders—the holders of financial assets—do not seriously believe that borrowers might default, and therefore are prepared to let them adopt very highly geared positions—in fact any gearing the borrowers themselves care to have. Nor do borrowers really fear that something might go wrong. In the Radcliffe Economy it will not.

I hold this to be the *sole important*, albeit concealed, logical *implication* both of the Radcliffe Theory and of the particular view of the working of the economy which seems to have inspired its authors, and propose to return to it when dealing with Radcliffe Policy.

The Interest Rate Muddle

Interest rates, the Report claims, have two potential effects. One is the 'incentive' (cost) effect; there is 'no convincing evidence of its presence' (386). The other is the 'general liquidity effect', which has, in some undefined way, to do with the 'availability of finance' (385); there is much evidence of its presence. This, we are told, is how this general liquidity effect works: 'A rise in interest rates makes some [financial institutions] less willing to lend because capital values have fallen' (393). However, capital values are merely another arithmetical expression for interest rates. Thus the statement reads: a rise in interest rates makes some less willing to lend because interest rates have risen.

It is not as hard as it looks to make sense of this sentence. If interest rates have risen and some holders of financial assets have inelastic expectations[1] (for example, some idea of 'normalcy' of rates—there is much evidence in the Report of this), they must expect them to fall again. To

[1] Elasticity of expectations is used here in the Hicksian sense. If the present rate is 4 per cent. and the expected rate 4¼, zero elasticity means that upon a rise in the rate to 5 per cent. the expected rate stays at 4¼ per cent.

sell a financial asset *now* therefore means forgoing not only its current interest yield but also the expected rise in its capital value.[1] To compensate for the yield-cum-appreciation so forgone, the yield in the alternative employment of the 'money' must be at least equal to this. It is not at all wild to put the opportunity cost of alternative investment under such circumstances at over 10 per cent.[2] And it is not in the least surprising that where a single-figure interest rate does not 'bite', a double-figure one does. This, as far as I can make out, is all there is to the Radcliffe Theory's 'general liquidity effect' of interest rates; it is the same as the incentive or cost effect, only bigger.

(In parentheses, the Committee have little excuse for failing to recognize this. They point in several places to the importance would-be investors attach to whether a rise in interest rates is temporary or permanent. If it is permanent, they will go ahead with their plans as if nothing had happened (451). If it is temporary, they may decide to postpone action, for the opportunity cost of taking it *now*, rather than *after* interest rates have returned to their expected lower level, is a double-figure interest rate (452).)

Radcliffe Policy, or The Nigger in the Woodpile

'Striking at general liquidity', in other words, seems to mean controlling demand by double-figure interest rates. But rates will only be double-figure ones to those asset-holders who have inelastic expectations and expect a fall upon each rise.[3]

This is an unsatisfactory state of affairs, partly because double-figure rates can inflict undesirably deep wounds on some while leaving others unaffected, and partly because interest-expectations may not be inelastic anyway; and if they are not, 'monetary policy can help'—slightly and marginally—'but that is all'.

[1] For a similar suggestion, cf. F. W. Paish's review of the Radcliffe Report, *The Banker*, Oct. 1959, p. 596.

[2] The alternative investment is, of course, unlikely to give a double-figure yield if (*a*) the money is lent shorter than it was borrowed (e.g. banks selling gilt-edged and making advances), or (*b*) it is put into physical capital. In either case, the rise in capital value upon the hoped-for fall in interest rates is zero or limited—in the case of investment in plant, by the supply price of similar plant, and in the case of the bank advance, by the terms of the contract.

[3] An expectation (whether elastic or inelastic) among a wide enough section of asset-holders that rates will be other than they are now is in any case hardly consistent with adoption of the Committee's suggestion that the managers of the national debt should 'take the gilt-edged market into their confidence'. By their advocacy (499, 565) of keeping long rates stable between infrequent major 'gear changes', or more precisely by the proposal that after each 'gear change' the authorities should advertise their intention to keep them stable (until a major change in the underlying situation calls for another 'gear change'), the Committee are dangerously weakening their own 'general liquidity effect' of a rise in rates, which must depend on asset-holders expecting that rates may fall *any time now* (and not merely in the medium-term future, by which time anything done now can be undone again at unchanged rates).

Expectations, however, will almost certainly be elastic, and a rise will *not* engender the expectation of a fall, in another respect which is more directly relevant to the Committee's concerns than mere interest rates: in respect, that is, of the general price level.[1] They will be elastic, in the sense that a rise in prices will make people expect at least the maintenance of the new higher price or a further rise, in a situation where the maintenance of full employment is taken for granted. For who will expect a significant fall in the general level of prices when aggregate demand is *known* to be underwritten as a matter of declared government policy? What incentive is there (to put it another way) for the holding of cash balances if prices will at worst remain constant, may rise, but certainly will not fall?

The simple rule of rationality in the holding of assets is that, after allowance for expected yields, the asset which is expected to appreciate is held in preference to that which is not. To put it in a rough and ready way, the more certain the belief that full employment will be maintained, the less likely it seems that money can appreciate relative to goods, therefore the weaker the incentive to hold money balances, i.e. the higher the income-velocity of circulation of money.

It is not particularly novel to seek the whole *raison d'être* of money in what is sometimes called uncertainty, sometimes risk, and in what I would prefer to call specific *and* inelastic price-expectations. The less the risk, or the more indefinite and elastic the price-expectations, the more elastic becomes that elusive entity, the 'monetary system'. In fact, as the Radcliffe Committee found, it becomes very much like a chewing-gum stretching readily to almost any length, with virtually indeterminate ratios, gearings, and circulation velocities.

If it is true that monetary control can really operate only where there is subjective risk, it is not surprising that the Radcliffe judgements on monetary policy are so resigned. The Radcliffe Theory may be bad logic—in fact, it almost certainly is—but the dispiriting character of the policy recommendations has little to do with the theory itself. It is, as this somewhat dead-pan survey of the theory was meant to show, directly due to the assumption of the Committee, which may or may not be well founded but which is certainly shared by a great many people, of a *riskless economy* (484). Certainty is the nigger in the woodpile; and monetary policy, which works by keeping people guessing, cannot be expected to achieve anything

[1] It is, of course, not at all odd that people should have inelastic expectations about the prices of financial assets and yet highly elastic ones about the general price level. The former relate to *relative* prices of present and future deliveries of money, the latter to *absolute* prices. People may hold ideas about normalcy in relative prices (ratios of prices) without necessarily retaining any idea of normalcy in the price level. Following Wicksell, they may compare relative prices to a swinging pendulum and absolute ones to a cylinder rolling along on a flat surface.

very important when people are not kept guessing about the most important economic variables: the level of employment, aggregate demand, and (by implication) the general level of prices.

Whether full employment should become a more tacit, less advertised, and lower-priority goal, maintained 'as far as feasible' but *without* any explicit governmental promise and guarantee to that effect—that is to say, whether subjective risk should be reintroduced into the modern economy in a major way—was perhaps not for the Radcliffe Committee to pronounce upon. On the other hand, it is a pity that their analysis failed to detect and place the responsibility for the impotence of monetary weapons where it belongs, thus by omission suggesting that the weapons are weak *qua* weapons and not merely in relation to the thick armour-plate with which electoral exigencies are shielding the modern economy.

Nuffield College, Oxford

EQUITY AND A CAPITAL GAINS TAX

By R. TURVEY

Introduction

The capital gains tax may not be a political possibility in the near future in this country, but it is not a topic which should be neglected on that account. Political impossibilities are not immutable, and it would be defeatist never to discuss anything which could not secure a parliamentary majority. Since the proposal to tax capital gains is, at least superficially, an attractive idea it seems worth while to examine the major issues involved. This paper therefore attempts such an examination. Specialists in public finance will not find anything new in it, but a survey of the most important arguments should be of value to other economists and to students who lack the time to work through the literature.[1]

There has been relatively little economic analysis of the effects of taxing capital gains and none will be attempted here. Aside from some controversy about possible yield, discussion of the tax has concentrated on issues of equity. The following pages therefore follow this pattern. First of all there is a brief note on the historical background and then the case for an ideal capital gains tax is examined. The remainder of the paper then argues that an ideal capital gains tax is unattainable because of the necessity of assessing gains on a realization rather than on an accrual basis. The sort of tax which is practically possible is shown to involve considerable departures from the ideal tax, so that a final decision on the desirability of taxing capital gains is far from easy even if one is fully convinced of the desirability of the ideal tax.

The Present System

As a preliminary it is interesting to inquire why many capital gains are not included in income and taxed as a part of it (as they used to be in the United States). To an economist there is nothing strange about the idea of including capital gains in income, thus defining it as equal to consumption plus the whole of the addition to the value of assets rather than plus just the value of the addition, but the legal concept of income as it developed in England was different. The need to measure income in a legal context

[1] The main sources used have been: (*a*) *Federal Income Tax Treatment of Capital Gains and Losses*, a U.S. Treasury Department Tax Study; (*b*) *Report of the Royal Commission on the Taxation of Profits and Income*, including the minority Memorandum of Dissent and the Inland Revenue memorandum 'The Taxation of Capital Gains' attached to it as an annexe; (*c*) *The Nature and Tax Treatment of Capital Gains and Losses* by Lawrence H. Seltzer, published by the N.B.E.R. Sir Roy Harrod, Dr. A. R. Prest, Mr. Paul Streeten, and Professor G. S. A. Wheatcroft have all made useful criticisms of earlier drafts of this paper and I am much indebted to them for their assistance.

arose with entailed estates where there was a tenant for life who was entitled to the income but not allowed to touch capital. Since estates were primarily agricultural, it was natural to regard income in terms of harvests, that is to say as something regular which was separated off from its source like fruit from a tree.

The consequence of this approach was that sporadic or unforeseeable gains which lacked a continuing source were not reckoned as income; the prudent man, after all, would regard these differently from regular receipts. Similarly changes in the capital value of an estate, the source of an income, were treated as income-yielding things like farms and land. Thus when the different kinds of taxable receipts and benefits were set out in the five schedules in 1803, nearly all of them were identified by source, i.e. as income from land, from trade, from offices and employment, and so on. There were exceptions to this, in that some classes of receipt were specified as income and in that there was a residual catch-all for items not elsewhere listed. None the less the general approach to the problem of defining taxable income was of a sort where capital gains did not find a place.

Since 1803 statutory changes and judicial interpretation have developed and refined the concept of taxable income. One change has been that recurrence or regularity is no longer required to make a receipt taxable. Profits from isolated transactions are sometimes taxable—when they can somehow be regarded as arising from a trade or an adventure in the nature of trade. Another change has related to depreciation. At first no allowance was made for wasting assets, but then there were breaches in this practice until now capital allowances are granted in respect of a wide range of capital expenditures. When an asset is sold for less than its depreciated value the difference, which is known as a 'balancing allowance', can be set off against gross profits. If this difference is due to obsolescence and is thus a capital loss, it reduces tax liability. There is not a complete symmetry with regard to capital gains, however, since the 'balancing charge' equal to the excess of sale proceeds over depreciated value is subject to a maximum, namely the depreciation already allowed. Thus if an asset is sold for more than its original cost the whole gain is not taxed. Furthermore, depreciation is not allowed on all real assets (e.g. commercial buildings). It would thus be incorrect to say that capital gains and losses on real assets used in production are all included in income.

The present position is therefore by no means simple and cannot be summarized briefly. Many capital gains and losses are not included in income. Some are, however, such as gains and losses where the taxpayer's business is the purchase and sale of assets, as in the case of used car dealers, stock jobbers, and property development companies. The gains and losses on securities of certain financial institutions are treated as taxable income

and so are gains from the sale of patents (which may be spread over a six-year period).

The complexity of the present tax system means that if capital gains taxation were introduced in such a way that gains were not incorporated in income but were taxed separately, it would be necessary to decide whether some gains and losses which are now treated as income should cease to be so. The new tax, in other words, besides being charged on those sales of terminable rights and of assets (notably paper assets) which are not taxed at present, might also be charged on, say, the sale of patents or of assets subject to depreciation allowances.

These problems have to be borne in mind in considering the details of any proposal to tax capital gains. The major problem which has to be solved first, however, is whether there are any broad categories of capital gain which should not be taxed, and to this question we now turn.

Why All Gains Should be Taxed

The case against exempting any capital gains from tax is simple. Suppose that Jones and Smith both have an income of £2,000 and both have a capital of £2,000 which they reinvest on 5 April. Suppose that they both sell off these assets on the following 4 April: Jones sells his for £2,500 and Smith sells his for £2,000. If both have the same family responsibilities, &c., then Jones is better off than Smith. It seems fair that he should pay more tax than Smith in respect of that year.

The case for reducing tax liability when capital losses are suffered is symmetrical and is consequently just as strong (or weak) a case. If Jones had sold for £1,500, other things the same, it seems fair that he should pay less tax than Smith. It is important to stress this, because much popular discussion of capital gains taxation ignores the problem of capital losses.

It seems to the present author that it would be fair to tax gambling winnings along with capital gains without treating gambling losses in the same way as capital losses. This suggestion does not, however, affect any of the subsequent arguments.

Counter arguments

It may be objected that if Jones makes a capital gain he is a clever man and deserves to benefit from his cleverness and that if he invests foolishly he deserves a loss. The same can be said of his earning a high or a low income, however, and the correct conclusion is not that there should be no tax but that the marginal rate of tax should be less than 100 per cent.

A much more important objection is that gains and losses caused by

changes in interest rates should not attract or reduce tax because they do not add to (or subtract from) spending power. Thus, if interest rates fall, the corresponding capital gains involve no increase in future receipts, while if the gain were realized and spent, future receipts would be diminished.

This overlooks the fact that the asset-owner is better off than he was before. If he does not spend the gain he has more capital than before and the same amount of income, while if he does spend the gain he reduces his income by a smaller amount than he would have done by disinvesting an equal sum in the absence of a fall in interest rates. It is true, however, that he is not made better off to the same extent as he would be either by an equal capital gain resulting from an increased earning power of his assets or from a single increment of income of equal amount. Thus to tax all capital gains would involve overtaxing some of them. The choice lies between this and undertaxing all those which are not at present included in taxable income.

The opponents of capital gains taxation claim that there is another kind of capital gain which should not attract tax. These are gains caused by inflation, where asset prices rise with asset incomes and the cost of living. If such purely nominal gains were taxed the gainers would pay more relatively to people whose incomes rose with the price level but had no assets. Since neither group gains or loses in real terms it is unfair to raise the tax levied on the first group relative to the second.

Another equally valid argument points in the opposite direction: the owners of assets whose value rises with the price level gain relatively to the owners of assets whose value is fixed in money terms, such as savings deposits and bonds. It therefore appears that although the taxation of inflationary capital gains would create unfairness between equity owners and wage and salary earners (a large group) it would remedy unfairness between equity owners and bond owners (a smaller group).

The obvious conclusion is that inflation should be avoided. If this is impossible the next best thing would be to tax real gains computed with the aid of a general consumer price index, so that only those nominal gains which are more than proportional to the movement in the price level are taxed. Otherwise it must be conceded that the expectation of future inflation or deflation weakens the case for capital gains taxation so far as the question of equity is concerned. Yet this is not necessarily to admit that on balance the tax system would be less fair, since many would consider the inequity done to be of less moment than the inequities righted.

A fourth argument against capital gains taxation is that the bulk of capital gains arise on ordinary shares and spring from the investment of undistributed profits. Since these have been taxed at the standard rate

of income tax and, in addition, the whole of company profits have been subjected to a 12½ per cent. profits tax, it is said, with some reason, that these gains have already been taxed indirectly.

Even if profits tax were confined to undistributed profits, the relationship between this tax burden and the capital gains enjoyed by shareholders would be pretty remote, however. Equity depends not only upon the tax treatment of shareholders as a class *vis-à-vis* other classes, but also upon the relative tax treatment of different shareholders. The capital gain obtained by an individual shareholder may diverge widely from his imputed portion of the undistributed profits during the period he held the shares. Indeed, if an owner suffers a capital loss during his period of ownership, the appropriate tax on his share of undistributed profits would be negative! Even if it were true that each shareholder's benefits were related in the same way to his share of the tax paid by the companies in which he held shares, taxing profits would be a poor method of taxing gains unless all shareholders were equally rich, since otherwise it would not be appropriate to tax all their profits at the same rate.

This argument against a capital gains tax is not convincing, therefore; if the taxation of undistributed profits is regarded as a substitute for the taxation of capital gains on shares it would appear that it is a very poor substitute, which suggests that it might be a good idea to abolish company taxation upon the introduction of capital gains taxation! The matter is not as simple as that, however, firstly because it can be argued that only part of the gain on shares should be taxed, and secondly because there are other grounds for taxing undistributed profits.

The first of these points arises because of the requirement that gains on different assets should not be treated differently. Consider a man who buys a farm for, say, £10,000, spends £2,000 on capital improvements, and sells it for £15,000. The taxable gain here is surely £3,000 rather than £5,000 (neglecting depreciation). If this is agreed, then parity of treatment requires that the man who buys £10,000 worth of equities, and has his aliquot share of undistributed profits amounting to £2,000 invested on his behalf, should be taxed on a capital gain of only £3,000 if he sells out for £15,000. It is just as though the shareholder initially acquired £10,000 worth in a company distributing all its profits, invested £2,000 of his dividend receipts in additional shares, and then sold the lot for £15,000. The capital gain is £3,000.

The second point is that the argument relates only to capital gains. Undistributed profits, while not part of capital gains, are income. Now most other income is taxed and there seems to be no good reason for exempting this, i.e. the income which forms the collective saving of shareholders. Income which is saved by individual shareholders and income

saved by non-corporate business owners is taxed and seems neither less nor more meritorious than company saving.

The result of these considerations is the conclusion, firstly, that capital gains tax on shares should be assessed in a way which excludes an amount equal to the selling shareholder's aliquot proportion of undistributed profits during the period when he held the shares. Secondly, undistributed profits should be charged to income and surtax in the same way as any other income.[1]

The trouble is that it would be very difficult to do these things. The first would involve an enormous amount of paper-work and would depend upon an arbitrary allocation of a trading year's profits over a part of the year, except when the shareholder bought the share at the beginning of a trading year and sold it at the end. As regards the second, it would be impracticable to take into account the tax bracket of each and every shareholder in a company in taxing its undistributed profits. The best that could be done would be the very rough justice of charging undistributed profits at a rate equal to the average of the marginal tax rates of shareholders at large (and removing the profits tax on undistributed profits).

The ideal can thus be approximated only with difficulty and rather crudely. Consequently two alternatives which are less difficult suggest themselves. One is to tax undistributed profits very heavily and to ignore capital gains and losses on shares. This differs from what is done at present in that it would involve dropping profits tax on distributed profits and perhaps altering the rate charged on undistributed profits from its present level (of the standard rate of income tax plus 12½ per cent. profits tax). The appropriate level would be the average of the marginal tax rates of shareowners plus an amount on account of capital gains.

From what has been said already, it is apparent that this would constitute an extremely crude approximation to the ideal. Since the ideal itself is subject to the two difficulties just named, we are left with the second of the two alternatives to it, namely leaving undistributed profits free of tax and charging to capital gains tax the whole of the increase in the value of shares (i.e. including the gain from ploughing back profits as well as the pure capital gain). This is equivalent to charging the pure capital gain and undistributed profits at the same rate, postponing payment of tax on the latter from the time the profits are made to the time the shares are sold. It thus differs from the ideal in that the shareholder is not charged interest when he postpones payment of tax. A shareholder who never sells his shares is therefore exempted from tax on his share of

[1] This paper is concerned only with equity and not with economic effects, but it is of great importance that the latter also be considered. The reader will note that the treatment of undistributed profits can exert a significant influence upon saving.

undistributed profits, since he is continually postponing the tax at no cost to himself.

This brings us to the first of four problems of implementing capital gains taxation which we shall consider. This is the problem of assessing gains and losses.

The Realization Basis

Capital gains and losses might be assessed to tax either as they accrue or when they are realized. If the former possibility were adopted, shareholders would pay tax each year as their shares rose in value, so that the postponement of tax would not occur. Unfortunately the accrual basis is impracticable, so that the drawback of the second alternative remains.

The reason why an accrual basis could not be adopted is that it would require the periodic valuation of all assets. Now it is difficult enough to value all a man's assets at the end of his lifetime, so to do it every year of his life as well and with sufficient accuracy to levy a tax on the difference from year to year would be almost impossible, except with quoted securities and to tax only gains on quoted securities on this basis would be unfairly discriminatory.

Realization, then, must be the basis of assessment. It would have to include not only outright sale for cash but other forms of realization as well. The main such forms are exchange for valuable consideration other than cash, receipt of insurance or compensation for loss, receipt of cash on liquidation and the granting of a lease for a capital sum. (Gambling winnings might also be included.) The basis of assessment would presumably be the proceeds of realization less the cost of acquisition. This would be a complicated concept; proceeds would have to be defined in terms of cash receipts or market value of the valuable consideration net of the cost of realization, while acquisition cost would have to take account of expenses of acquisition and include capital expenditure on the asset after its acquisition.

Without going any farther into these technical problems, some matters for discussion immediately arise. One is the assessment of the acquisition cost of assets acquired before the introduction of the tax. This transitional problem might be met in two ways, either by treating value when the tax was introduced as acquisition cost or by pro-rating the gain over the time since acquisition and regarding only the fraction attributable to the period since the tax as a taxable gain.[1]

[1] There is an additional point concerning the equity of capital gains taxation which Sir Roy Harrod has suggested to me. It relates to the introduction rather than to the continuing existence of capital gains taxation. The announcement of the tax would presumably result in a fall in the value of those assets which have low yields because of expected future appreciation. Even if the lower value were disregarded in assessing tax on subsequent realization, as suggested above, those people who owned such assets at the moment when the tax was announced would complain.

Another point is that property transferred at death should be regarded as realized and the gains charged to capital gains tax as a charge on the estate prior to the levy of death duties. If this were not done, Jones with accrued but unrealized gains at death could leave more than Smith who had had the same income and consumption during his lifetime but no unrealized gains at death. Equity therefore requires that Jones pay more tax than Smith, and since this cannot be levied on an accrual basis while he is alive it must be known that it will be done when he is dead!

An analogous argument applies to the transfer of property by gift. If people are to be taxed on the sum of their consumption and net saving (increase in net worth) it would be as anomalous to exempt some saving for descendants as to exempt some of that consumption which takes the form of gifts.

Exemptions

A second problem of capital gains taxation is that as with practically all taxes, various exemptions have been proposed. Exemptions and exceptions usually complicate the administration of a tax and often provide unintended loopholes, so they deserve very careful scrutiny. Yet two exemptions which have been suggested for the capital gains tax seem justifiable. One is the exchange of securities in company reorganizations and the other is forced conversions, such as the compulsory acquisition of real property, the receipt of insurance and the nationalization of industry, where the acquisition cost of the old assets replaced by the new ones might be deemed to be the acquisition cost of the new ones.

Another exemption which has been suggested is the sale of owner-occupied houses. The reason for this exemption put forward by the minority of the Royal Commission was that to tax gains on the sale of such houses would be hard on owners who were selling in order to move to another house when these gains were nominal rather than real, caused by inflation. Yet exemption would also exempt non-inflationary gains on houses and in any case if other inflationary gains are to be taxed it seems peculiar to exempt this particular category. If they are to be given special treatment the reason should rather be that moving house is similar to forced conversions. The appropriate procedure might be similar to that suggested in the case of forced conversions: where one house is bought to replace another there would be no capital gains tax but the acquisition cost of the new property would be taken as the cost of the old property when it was acquired plus or minus any difference in the current market values of the two properties. Thus, if a house which cost £3,000 is sold for £4,000, and its owner moved to another house which he buys for £4,500 he would

pay no capital gains tax but the acquisition cost of the new house would be calculated as £3,000+£4,500—£4,000 = £3,500.

The Progression Problem

So far there has been no discussion of the extent to which a capital gains tax should be linked with income tax—here understanding this term to include surtax. To include capital gains in income and deduct capital losses from it, thus incorporating capital gains taxation with income taxation, would raise the problem of progression, however, as an example will show.

Suppose that Jones has had £1,200 p.a. income and no capital gains or losses in each of the past five years while Smith has received £1,000 p.a. income in each year and, in addition, realized a capital gain of £1,000 in one year. If capital gains were included in income for tax purposes, Jones would pay tax on £1,200 five times while Smith would pay tax on £1,000 four times and on £2,000 once. With progressive taxation Smith's total tax payment would exceed Jones's even though both had received exactly the same amount in total.

This sort of problem arises under the present tax system with fluctuating incomes. It would be particularly acute if capital gains were included in taxable income, however, because capital gains frequently accrue over a number of years and are then realized in a single sale as, for instance, when a business is built up and then disposed of.

A good deal of ingenuity has been devoted to thinking up ways of dealing with the progression problem. The matter is an important one because there are two very good reasons for wishing to incorporate capital gains taxation with income tax. One is simply that since the case for taxing capital gains is that they make people better off in just the same way as income, progression should apply to the sum of the two and not just to income. If it be right that a man earning £2,000 p.a. should dispose of a smaller fraction of £100 salary increase than a man earning £1,000 p.a. it is surely also right that he should pay more tax out of £100 capital gain. The other reason for wishing to incorporate capital gains in income taxation is an administrative one. If there were no need to distinguish a capital gain from income, or a loss from a deductible expense, a myriad of administrative and accounting complexities would be avoided.

Unfortunately, the only proposal which deals with the problem properly, Vickrey's cumulative averaging described in his *Agenda for Progressive Taxation*, is generally regarded as too complicated. Even a simple average basis of assessment would present great difficulty. It therefore appears that if capital gains were to be taxed and losses were to be allowed it would probably be necessary to distinguish them from income. The rate at which

they would be taxed might be fixed in a number of ways, four of which are as follows:

1. Capital gains would be included in income but taxpayers could exercise a once and for all option to spread capital gains over, say, five years.
2. Capital gains would be taxed at the marginal income tax rate of the recipient. Thus if a man's marginal rate of income (and sur) tax were 70 per cent., he would pay 70 per cent. on gains, whatever their magnitude.
3. Capital gains which had accrued within the tax year would be included in income and all other capital gains would be taxed at a flat rate.
4. All capital gains would be taxed at a flat rate.

These are only four of many possibilities, but they suffice to demonstrate an important point. This is that the less complicated the device that is chosen, the further would capital gains taxation diverge from the equitable ideal.

The Treatment of Losses

The fourth problem to be discussed here is the treatment of capital losses. The point was made earlier that the case for reducing tax in respect of capital losses is as good as the case for imposing tax in respect of capital gains. Indeed, it can be argued that to introduce a new tax which was significantly less generous with losses than it was onerous with gains might lessen rather than increase the fairness of the tax system, since gainers and losers are not two distinct sets of people. The special problems which arise in the treatment of losses therefore deserve consideration.

There are two practical possibilities where gains and losses are not incorporated into income. One is that losses in excess of gains in any one year could only be carried forward and offset against gains in subsequent years. The other is that losses in excess of gains multiplied by the relevant tax rate could be set off against the tax due on income.

The first alternative, namely no offset against income tax and unlimited carryforward, would presumably involve the right to credit any net losses unabsorbed at death against estate duty. This would not treat gains and losses symmetrically, as an example will show. Suppose that Jones realized gains during his life but suffered no losses, realized or unrealized, while Smith had the opposite experience, realizing losses but having neither realized nor unrealized gains. Then Jones will pay tax on his gains as they are realized while Smith will receive no tax credit for his losses until his death.

This suggests that it might be preferable to allow losses to be set off against income (though even this would not achieve full symmetry where

losses exceeded income, unless the taxpayer received a subsidy in respect of the excess). Thus, if a man's marginal rate of tax on income of, say, 50 per cent. were applied to his capital gains and losses, or if they were taxed at a flat rate of 50 per cent. he would pay £50 extra tax on a £100 capital gain and reduce his payment by £50 if he realized a capital loss of £100. This provides almost complete symmetry of treatment and does not discriminate against risk as an asymmetrical treatment would, so that the application of high marginal tax rates need not be inhibited by a desire to encourage risk taking; progression according to income could thus be a feature of capital gains taxation.

An argument allowing losses to be set off against income is that a man with both accrued losses and accrued gains could choose to realize the losses but not the gains, so being liable to less tax during his lifetime than in the absence of a capital gains tax! Correspondingly more would be due on his death, however, first in capital gains tax and then in death duties on the remainder. What would be involved, therefore, would be a voluntary postponement till death of the tax on gains. The alternative of allowing losses in excess of gains to be carried forward but not to be used to reduce tax on current income would sometimes involve a compulsory postponement till death of a relief against losses. Thus it has to be decided which of these two drawbacks is the greater. Voluntary postponement would allow people in a position to help themselves to reap a tax advantage, while compulsory postponement would compel those unable to help themselves to suffer a tax disadvantage.

Where there is a possibility that by skilful timing of asset realization, losses could be used to reduce tax at high rates and gains would be charged at low rates, voluntary postponement has little to be said for it. If, for instance, the tax rate applied to gains or losses depended upon income, a man could realize losses when his income was high and realize gains during his retirement. With a flat-rate tax, voluntary postponement would merely allow the taxpayer to earn interest by postponement.

Compulsory postponement, on the other hand, would be less of a hardship if losses carried forward were allowed to accumulate interest. Thus, if Smith's capital losses exceeded his capital gains by £1,000 in any year he would pay no less tax than Jones who had the same income but neither gains nor losses. In the following year, however, assuming a 5 per cent. rate, Smith would pay capital gains tax only if his net capital gains in that year exceeded £1,050.

Summary

The first part of this paper shows that there is much to be said for an ideal tax on capital gains, though it would create some inequities while

remedying other ones so that it is a matter of judgement to decide whether it would be fair on balance. The second part of the paper then revealed a number of difficulties which any proponent of capital gains taxation must face. The sort of tax which could be introduced would differ from the ideal because of the impossibility of an accrual basis. This creates the major difficulties which have been discussed, namely:

Under-taxation of long-term shareholders in companies with significantly large undistributed profits versus the crudity of getting at capital gains on shares by heavy taxation of undistributed profits.

The impossibility of integrating capital gains taxation with income taxation so as to secure desirable progressivity and simplify taxation while avoiding excessively high taxation of large capital gains.

The difficulty of treating losses symmetrically with gains without creating possibilities of avoidance through tax postponement.

The simplest system of capital gains taxation would be to tax all net gains at a flat rate and allow losses in excess of gains to be carried forward, accruing interest, for offset against future gains. The necessity of distinguishing gains and losses from income would not be avoided and progression would not be secured under this system. Another disadvantage is that it would not achieve anything like the ideal treatment of undistributed profits.

The end result, then, is that the practical choice is a matter of whether an imperfect capital gains tax is better than none.

London School of Economics

A STATIC INTERPRETATION OF SOME RECENT THEORIES OF GROWTH AND DISTRIBUTION

By CHARLES KENNEDY

I. Introduction

In this paper an attempt is made to lay bare the static structure of a number of recent models of growth and distribution. In case it should be thought that the title of the paper itself contains a contradiction in terms, I must make it clear at once that I am using the term 'static' in the sense advocated by Professor Frisch: i.e. a static model is one in which all the functional relationships are between variables of the same time-period.[1] The theories of growth and distribution that I shall consider are taken from four contributions: those of Sir Roy Harrod in *Towards a Dynamic Economics*,[2] of Professor Hicks in *The Trade Cycle*,[3] of Mr. Kaldor in 'Alternative Theories of Distribution',[4] and of Mrs. Robinson in *The Accumulation of Capital*.[5]

It has now been fairly widely accepted that it is possible to analyse even a growing economy by the use of a static method;[6] but it may be questioned whether such an undertaking is worthwhile. The main advantage seems to me that it makes the comparison of different theories very much easier. The four writers mentioned above use a greater or lesser degree of what one might call dynamic elaboration, and there is something to be gained by forcing their theories into a single static straitjacket. The differences and similarities between the basic structures of their various systems then stand out very clearly. The particular straitjacket that I shall use in what follows has also the advantage of being very familiar: it is none other than the equilibrium condition that

$$I = S.$$

I shall use this equation, however, in a slightly modified form, with each side divided by Y. The suggestion that both sides of the investment-savings should be divided by the level of income is of course due to Sir Roy Harrod, and may quite fairly be said to have been responsible for the break-through in this field.[7] One merit of this equilibrium condition is that it can be represented graphically by the intersection of two curves,

[1] 'On the Notion of Equilibrium and Disequilibrium', *Review of Economic Studies*, vol. iii, pp. 100–6. See also Samuelson, *Foundations of Economic Analysis*, Harvard University Press, 1948, pp. 313–14; Schumpeter, *History of Economic Analysis*, Allen and Unwin, 1954, p. 963.

[2] Macmillan, 1948. [3] Oxford, 1950.

[4] *Review of Economic Studies*, vol. xxiii (2). [5] Macmillan, 1956.

[6] See Samuelson, loc. cit.; Schumpeter, op. cit., p. 964.

[7] Harrod, op. cit., p. 80n.

and this applies equally when the modified version is used.[1] Indeed the main purpose of this paper is to give a simple diagrammatic representation of the models under consideration. The first three contributions cited above admit very readily of such a simple diagrammatic treatment. In the case of Mrs. Robinson's model, however, a certain amount of forcing is required, though the difficulties encountered are possibly not without interest in themselves.

A subsidiary advantage of using a static method is that it enables one to dispense with many of the special assumptions which become necessary if a dynamic treatment is attempted. In order to exploit this advantage, I shall allow myself very considerable freedom when translating the different theories into my own terms.

I must end this introduction with two disclaimers. Firstly, it must not be imagined that the four diagrams which follow purport in any way to give a comprehensive account of the contributions under discussion. My one purpose has been to isolate, for the sake of easier comparison, a certain very limited aspect of these contributions.[2] Secondly, I make no claim to originality in what follows. All the ingredients are to be found, explicitly or implicitly, in the writings of the authors cited, however much they may wish to repudiate the use to which they have been put.

II. The 'Harrod' Model[3]

Sir Roy Harrod takes the equilibrium condition

$$\frac{I}{Y} = \frac{S}{Y}$$

and discusses further the two sides of the equation. The right-hand side, i.e. the savings-ratio (s) of the community, is regarded as an independent[4] variable of the system. The left-hand side is analysed further as the product of two terms: $G\,(=\Delta Y/Y)$, the rate of growth of output, and $c\,(=I/\Delta Y)$ the (marginal) capital–output ratio. Thus we obtain the now famous Harrod equation

$$Gc = s.$$

[1] Kaldor in his later article ('A Model of Economic Growth', *Economic Journal*, Dec. 1957) has made use of such a diagram. In the diagrams that follow in the text, I measure I/Y and S/Y along the horizontal axis and not up the vertical axis as Kaldor does. This seemed to me more in line with the usual practice in economics, but I hope the change will not cause confusion. Kaldor's later article lies outside the scope of this paper.

[2] I shall try to specify, either in the text or in footnotes, what part of a particular contribution I am attempting to interpret.

[3] In the 'Harrod' model I am concerned only with Harrod's theory of the 'warranted' rate of growth (op. cit., pp. 77 et seq.). I shall not be concerned with his discussion of the instability of the equilibrium line of advance, nor with his discussion of divergences between the 'warranted' and the 'natural' rates of growth. The inverted commas in this and later sub-headings are to remind the reader that I have taken great liberties with my authorities.

[4] By 'independent' I mean 'independently given' or in more technical language 'exogenous'.

c, like s, is regarded as an independent variable, which leaves G as the dependent variable of the system.

This model can be very simply illustrated on a graph, with I/Y and S/Y measured along the horizontal axis and G measured up the vertical axis (Fig. 1). The S/Y curve is then a vertical straight line, and the I/Y curve is a straight line of slope $1/c$ passing through the origin. The intersection of the two curves determines the equilibrium rate of growth G_w (in Harrod's own terminology the 'warranted' rate of growth).

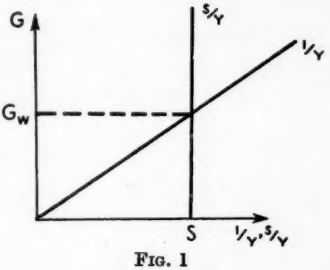

FIG. 1

This is the 'Harrod' model, stripped to its barest static form.

III. The 'Hicks' Model

The greater part of Professor Hicks's book deals with fluctuations. We shall be concerned only with his theory of equilibrium growth, i.e. the theory of the Super-Multiplier.[1] This theory itself contains dynamic relationships, but there is little difficulty in putting it into a static form. All that is required is to make the investment function and the consumption function hold without time-lag. When the 'Hicks' model is made static in this way, it has one essential difference from the 'Harrod' model, due to the introduction of Autonomous Investment.[2] In our analysis of the 'Hicks' model we shall use the symbol I to refer only to Induced Investment. Our amended equilibrium condition then becomes

$$\frac{I+A}{Y} = \frac{S}{Y},$$

where A is Autonomous Investment, and the Harrod equation can be written

$$Gv+G(c-v) = s,$$

where v is the (marginal) capital–output ratio for Induced Investment. The 'Hicks' model can then be illustrated by a diagram similar to the one used for the 'Harrod' model (Fig. 2).

The I/Y and S/Y curves are the same as before. But whereas in the 'Harrod' model the rate of growth of output was the dependent variable of the system, in the 'Hicks' model it is fixed by the rate of growth of Autonomous Investment, which is given independently. This means that for the purposes of our static model, the rate of growth of output G can be regarded as given, i.e. as an independent variable of the system.[3]

[1] Op. cit., chap. v.

[2] This needs qualification, because Harrod himself introduces a term k, similar to Autonomous Investment (on p. 79). But it plays a minor part in the development of his ideas, so that it seems justifiable to regard Autonomous Investment as the distinguishing feature of the 'Hicks' model.

[3] Cf. Hicks, op. cit., pp. 60–61 and 183–4.

For equilibrium to be possible, the given rate of growth (say g) must have a value such that I/Y is less than S/Y. Total investment must still be equal to saving, however, so that the horizontal distance between the I/Y and S/Y curves must be equal to A/Y. Since Autonomous Investment (A) is, as its name implies, independently given, the equilibrium condition in this case determines Y, the *level* of output. In other words, A/Y adapts itself to a given rate of growth through variations in Y.

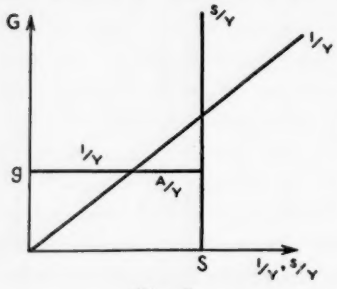

FIG. 2

The actual determination of Y does not come out very clearly from Fig. 2, the main purpose of which is to draw attention to a feature of the 'Hicks' model which, though it has not gone unnoticed, perhaps deserves special emphasis. This concerns the capital–output ratio. I/Y is tied to the rate of growth G because of the assumption of a fixed capital–output ratio, just as in the 'Harrod' model. Thus, as G rises, so must I/Y. Autonomous Investment, on the other hand, is quite unconcerned with capital–output ratios, and A/Y will actually fall as G rises.

This may be seen equally well from the Hicksian version of the Harrod equation

$$Gv+G(c-v) = s.$$

In the 'Hicks' model, G, v, and s are all independent variables of the system, which leaves c as the dependent variable. In summary, we may say that both the 'Harrod' and the 'Hicks' models take the savings-ratio as given, but whereas in the 'Harrod' model it is the capital–output ratio which determines the rate of growth of output, in the 'Hicks' model it is the other way round.

IV. The 'Kaldor' Model

So far we have been dealing with theories of growth pure and simple. With the contributions of Mr. Kaldor and Mrs. Robinson, we come to theories of growth and distribution. We shall deal with Mr. Kaldor's contribution first, since it is very much the simpler.[1]

In the 'Kaldor' model, the rate of growth (G) is an independent variable, equal either to the 'natural' rate of growth as determined by population increases and the rate of technical progress, or alternatively to the entrepreneurs' desired rate of growth. The capital–output ratio (c) is also an

[1] I shall be concerned only with section IV of Kaldor's article, entitled 'The Keynesian Theory' (pp. 94 et seq.).

independent variable, as in the 'Harrod' model. The new feature of the 'Kaldor' model is on the right-hand side of the basic equilibrium condition. For the savings-ratio (s) is now not regarded as fixed, but as dependent on the distribution of income in the economy. In order to fit the 'Kaldor' model, the Harrod equation has to be amended to

$$Gc = s(P/Y),$$

where P is the level of profits in the economy and s is now a functional symbol.

This model can be illustrated graphically, if we measure P/Y up the vertical axis, and I/Y and S/Y as before along the horizontal axis (Fig. 3). Since both G and c are independent variables, the I/Y curve will be a vertical straight line. The S/Y curve, on the other hand, will slope upwards from left to right, since the savings-ratio can be expected to be greater, the greater the share of income going to profits. We shall assume further that the S/Y curve cuts the vertical axis, i.e. that there is some positive profits-ratio at which the savings-ratio is zero.[1] At the intersection of the two curves the equilibrium distribution of income is determined. Thus, in the 'Kaldor' model, G and c are independent variables of the system and the dependent variable is P/Y, the share of income that goes to profits.

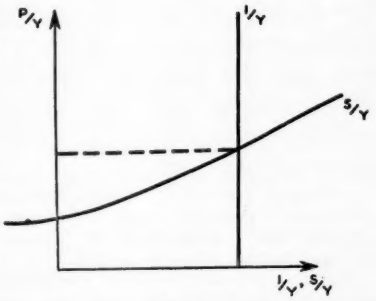

FIG. 3

V. The 'Joan Robinson' Model

We come finally to Mrs. Robinson's contribution, which from a static point of view is the most complex.[2] This is because she seeks to incorporate into the theory of a growing economy a notoriously difficult element, namely the Wicksellian theory of capital. I shall attempt only the briefest summary of this theory here. Wicksell's achievement was to establish a relationship, with given technological conditions and *under the assumption of a stationary state*, between the real wage and the method of production,

[1] In Kaldor's own formulation, the S/Y curve would be a straight line cutting the horizontal axis, because of the particular assumptions he makes about the savings-ratio of different classes (p. 95).

[2] The 'Joan Robinson' model is very largely based on her Note on Mr. Harrod's Dynamics (op. cit., pp. 404–6), which provides in itself a convenient summary of a large part of the earlier discussion of her book.

characterized in Wicksell's case by the 'period of production'.[1] This meant also that, under stationary state assumptions, a definite relationship could be established between the real wage and the capital–output ratio of the economy. The capital–output ratio is influenced by a change in the real wage, not only because the technique of production alters, but also because the price of capital goods in terms of commodities alters—the so-called Wicksell effect.[2] Normally, the higher the real wage, the more mechanistic will be the method of production and the higher the capital–output ratio.[3]

The assumption of a stationary state, however, is clearly incompatible with any analysis of growth; and it was here that Mrs. Robinson made the fruitful discovery that the stationary state assumption could be replaced by the assumption of a 'golden age', a state of the economy in which the real wage, the rate of growth of output, and the rate of profit on capital are all constant over time. In a golden age, as in a stationary state, a definite relationship can be established between the real wage and the capital–output ratio.

[1] Wicksell, *Lectures* (Routledge, 1938), vol. i, pp. 144 et seq.; *Value, Capital and Rent* (Allen and Unwin, 1954), pp. 120 et seq. Mrs. Robinson does not follow Wicksell in adopting the Austrian notion of a 'period of production', but this is a matter of detail. Cf. Joan Robinson, op. cit., p. 396.

[2] The vexed question of the measurement of capital arises at this point. Indeed, it should perhaps have arisen during the discussion of the 'Kaldor' model, since the Wicksell effect can be operative even when the technique of production remains unchanged. However, Kaldor, although he mentions the influence of a change in the rate of profit (and therefore on the real wage) on the price of capital goods, chooses to ignore it (op. cit., p. 98), so that in the 'Kaldor' model it remained possible to treat the capital–output ratio as independently given. The measurement of capital has recently been so fully discussed that I shall confine myself to a short comment. When, in her original article in the *Review of Economic Studies* ('The Production Function and the Theory of Capital', vol. xxi (2)) Mrs. Robinson criticized the measurement of capital in physical terms and proposed instead a measure in terms of value per wage-unit, a number of objections were raised which were also repeated on the publication of her book. Klein's otherwise appreciative review in *Econometrica* (Oct. 1958) may be taken as an example of this approach. Now it seems to me that the delay in taking Mrs. Robinson's point stems from a failure, explicit in Klein's case, to recognize where Mrs. Robinson's work as a whole was leading. As soon as one interprets her recent work as a development of Harrod's *Dynamic Economics*, then her worries about the measurement of capital become not only understandable but also justified. For, if one needs a measure of capital in order to arrive at a capital–output ratio which is itself to be used as an element in the analysis of I/Y, then that measure must be in value terms. No doubt Mrs. Robinson's criticisms of the physical measure were too sweeping: there are some problems in the theory of capital for which a physical measure may be quite appropriate. But she is surely absolutely right to insist that, for the problems she herself is concerned with, a value measure is needed. In my own opinion, the key to the understanding of much of Mrs. Robinson's recent work lies in her Note on Mr. Harrod's Dynamics, which should be read before and not after embarking on the main text of her book. On all this, see, as well as references already cited: Joan Robinson, *Review of Economic Studies*, vol. xxiii (3), *Economic Journal*, Sept. 1958, and Sept. 1959, *Econometrica*, July 1959; Champernowne, *Review of Economic Studies*, vol. xxi (2); Solow, *Review of Economic Studies*, vol. xxiii (2), *Q.J.E.*, Feb. 1956; Swan, *Economic Record*, Nov. 1956; Little, *O.E.P.*, June 1957.

[3] But the Wicksell effect can operate in the other direction, tending to reduce the price of capital goods in terms of commodities as the real wage rises. Cf. for example, Little, op. cit., Appendix.

Let us return once more to the Harrod equation

$$Gc = s$$

to see how far we can go at this stage in the setting-up of a 'Joan Robinson' model. The savings-ratio (s) can be taken as depending on the share of income that goes to profits as in the 'Kaldor' model; the rate of growth (G) can be taken, again as in the 'Kaldor' model, as an independent variable of the system; and the capital–output ratio (c) will, under golden age assumptions, be a function of the real wage. It will be seen that there are still more variables than can be accommodated on a two-dimensional diagram, for unfortunately the real wage is not the same thing as the share of wages in income. However, in a golden age the real wage and the share of profits in income are not independent of each other. For since, corresponding to any given real wage there will be a definite rate of profit on capital as well as a definite capital–output ratio, it follows that there will also be a definite share of profits in income. It does not follow, however, that the share of profits will necessarily fall as the real wage rises, since the effect of the fall in the rate of profit may be outweighed by that of the higher capital–output ratio.

Before the 'Joan Robinson' model can be illustrated, it has to be decided whether to measure the real wage or the share of profits up the vertical axis. I prefer to take the latter, because in this case the model is more easily comparable with the 'Kaldor' model. The 'Joan Robinson' model can now be illustrated in Fig. 4. The S/Y curve is the same as in the 'Kaldor' model, and it is the I/Y curve which causes the difficulty. It will be remembered that I/Y is equal to Gc and that G is independently given. Now it seems clear that at a very low real wage, the capital–output ratio will be small and the share of profits very high (i.e. near unity). Also, provided that there are technical limits to the possibility of mechanization (i.e. that the productivity of labour cannot be indefinitely increased by the introduction of more roundabout or mechanistic techniques), there will be some maximum level of the real wage at which the share of profits will be zero while the capital–output ratio is high. Thus, the general tendency of the I/Y curve will be to slope down to the right. In Fig. 4 it has been so drawn throughout its length, but it is quite possible, and indeed not even improbable, that it will slope upwards to the right for part of its length, so that a higher capital–output ratio (due to a higher real wage) will correspond to a higher share of profits. The intersection of the I/Y and S/Y curves will determine the equilibrium share of profits in income.

If the rate of growth were altered, a new curve could be drawn up on the same lines. Indeed, a family of curves could be drawn for different

rates of growth. An interesting special case would be where the rate of growth was zero: then the I/Y curve would coincide with the vertical axis, and the equilibrium share of profits would be determined by the thriftiness of the community.[1] As Mrs. Robinson has pointed out, a stationary state can be regarded as a special case of a golden age.

To sum up, the 'Joan Robinson' model differs from the 'Kaldor' model in that the capital–output ratio is not independently given, but is associated with the share of profits, though it is important to remember that this association can only be established if a golden age is assumed. Like the others, this model can be described algebraically by an adaptation of the Harrod equation:

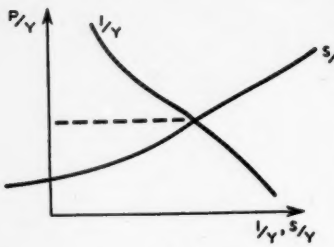

FIG. 4

$$Gc(P/Y) = s(P/Y),$$

where c like s is now a functional symbol, G is an independent variable of the system, and P/Y the dependent variable.

VI. Concluding Remarks

In the foregoing sections an attempt has been made to translate four different contributions to the theory of growth and distribution into the language of static equilibrium analysis. Of what value is such equilibrium analysis? Professor Samuelson has taught us that in itself it has very limited significance. For even to discuss the stability of the equilibrium—and on this depends whether there will be any tendency towards the equilibrium—it is necessary to have also a dynamic disequilibrium theory.[2] There seems to be little doubt that the first three models can be dynamized without difficulty,[3] but unfortunately the same is not true of the 'Joan Robinson' model, which in other ways is the most comprehensive—and certainly the most ambitious. This is because of the golden age assumption, which means that equilibrium has already to be assumed before the I/Y curve can be drawn at all; and this rules out any use of the I/Y curve as an element of a disequilibrium theory. In using the 'Joan Robinson' model, we are limited to the mere comparison of different hypothetical golden age economies.

This seems to be a difficulty, not only of the 'Joan Robinson' model as

[1] Cf. Little, op. cit., p. 161.
[2] Op. cit., pp. 257 et seq.
[3] It would be more correct to say that they have already been dynamized by the authors concerned.

we have set it up, but of the golden age assumption itself.[1] It is an assumption that takes one a long way—but that then prevents one from going any farther.

[1] As has been recognized by Mrs. Robinson herself at least in so far as the 'stationary state' is concerned. Cf. *Economic Journal*, Sept. 1959, p. 441. Wicksell was also worried about the point: cf. *Lectures*, vol. i, pp. 202–3.

The Queen's College, Oxford

INDUSTRIALIZATION IN OVERPOPULATED AREAS, A GEOMETRIC INTERPRETATION OF CERTAIN ASPECTS

By F. SETON

It is often thought that the greatest potential for development in many areas of the world lies in the transfer of surplus agricultural labour to 'industry'—where this is taken to include constructional activity of all sorts, whether urban or rural. In this article we attempt to reduce to formal terms a number of the questions most commonly associated with such a policy:

1. What are the economic constraints which limit the pace of the transfer, i.e. the terms on which industry can secure the release of labour from agriculture in exchange for its own products; and what is the 'best' that can be achieved, given these terms?
2. If the terms themselves are variable, e.g. at the cost of limiting the pace of capital accumulation, what determines the 'best' terms that should be sought?
3. To what extent, if any, is this optimum independent of the subjective weights given to the claims of consumption and capital accumulation?

Our interest centres on the formal and conceptual apparatus that may be brought to bear on these problems. Much that is relevant and all too real is therefore neglected.

The 'Release Price' of Labour

The justly celebrated prescriptions of Pareto optimality are often felt to be of little help to over-populated countries on the threshold of industrialization. No one would want to quarrel with the principle of the 'contract curve'—as beguiling a piece of geometry as has ever been invented to show that the marginal rates of substitution between commodities (or factors) should be equalized for all consumers (or producers). But the difficulties arise when the pattern of resource allocation is historically set too far away from this ideal, and the mobility of factors too low to permit any decisive movement towards it. This may be illustrated by drawing the equi-product lines of an over-populated agricultural sector y_1, y_2,..., with long stretches parallel to the labour-axis (marginal productivity = 0), and the equi-product lines of industry x_1, x_2,..., with normal curvatures. The resulting locus of optimum points LM (mutual tangentiality of x- and y-curves) will be relatively far on the right-hand side of the diagram, though the traditional resource allocation will probably lie somewhere in

the region of T. Labour cannot be moved out of agriculture, nor capital created by industry, at anything like the necessary speed to shift T all the way to LM within a time-horizon of operational significance. What would seem to be needed, therefore, is not so much an awareness of the static

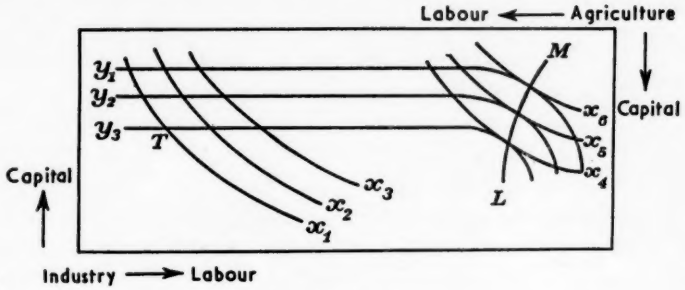

FIG. 1

criteria of optimality as some sort of guidance on how the distant ideal may be most efficiently or painlessly approached over prolonged periods of time.

This requires, first and foremost, an explicit statement of the chief constraints to which underdeveloped economies are normally thought to be subject. The most important of these can be brought out quite easily on a two-dimensional diagram (Fig. 2):

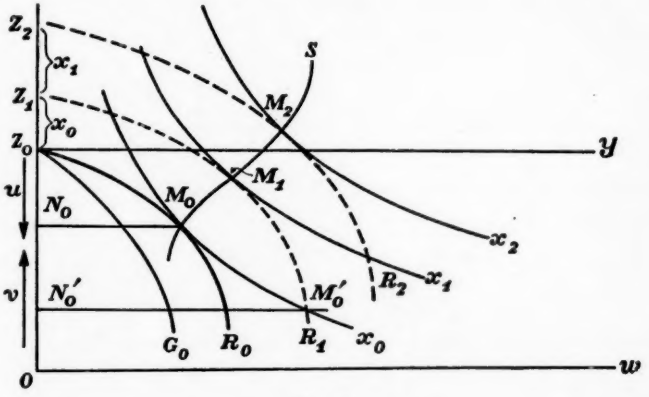

FIG. 2

Let the curves $x_0, x_1, \ldots$, represent the contours of a production function of the familiar type $x = F(v, w)$ linking capital inputs (v) and employment of labour (w) with the output of 'industry'—which is deemed to encompass all non-agricultural activity and to be devoted entirely to the production of

capital goods (for use in both agriculture and industry). We shall suppose that the country's stock of capital is OZ_0 ($= z_0$) and that it is sufficiently non-specific to allow of shifts between agriculture and industry within the relevant range. The output of agriculture y (= food only) is presumed to be unaffected by any variations in the rural labour force that are in practice conceivable, and to depend solely on the employment of capital on the land (u). Its production function $y = G(u)$ is therefore collapsible into the line G, where u is measured vertically downwards from Z_0 and y along the raised axis parallel to w.†

We shall be concerned with the case where the severest limit to industrial employment is set by the surplus of food which can be made available for off-farm consumption. In a closed economy of the kind we are considering this surplus cannot be controlled by price incentives to the peasants; for in the absence of industrial consumer goods and the desire (or capacity) of individual peasants to invest in machinery,‡ industry has nothing acceptable to offer them in exchange for food, however favourable the terms might be. It follows that the crucial surplus will solely depend on the extent to which the peasants are impelled to part with their crops without a *quid pro quo* recognized as such by themselves, e.g. through socage, rent, usury, or government taxation. Given this 'coercive potential' of the economy (which in many modern countries is largely identical with the government's political and/or technical ability to tax the peasants),§ the number of industrial workers which it will be possible to employ should emerge as a simple increasing function of the total food output on which this potential is able to operate, i.e. $w = P(y)$, where P_y ($= dP/dy$) is evidently the 'marginal power of food' to release labour for industry, and its reciprocal (y_w) the marginal food-cost of industrial labour‖ (which may, of course, be constant). Hence, at any given level of capital endowment (z_0), the food output obtainable from u units of capital as marked out by the G-curve may be uniquely transformed into the number of industrially employable workers:

$$(1) \qquad w = P(y) = P[G(u)] = T(u) = T(z_0 - v) \equiv R(v).$$

The resulting curve R, when looked at from the origin Z_0, shows the way

† The curve $G(u)$ may be regarded as a vertical section through the production surface of agriculture in Fig. 1 at right angles to the horizontal stretches of the Y-curves, 'folded' into the (v, w)-plane.

‡ It is assumed that the capital employed in agriculture operates mainly in the framework of government-sponsored community development schemes or state-run farms.

§ If the government can get the peasants to accept communally operated machinery or melioration as a *quid pro quo* for food, the term 'persuasive potential' would of course be more appropriate.

‖ This is normally much less than the food consumption (= wage) of the industrial worker, since a part of it represents a mere transfer from the peasant consumer and does not constitute an additional claim on food resources.

in which agricultural capital can be 'transformed' into industrial labour; looked at from O in the normal way, it shows the terms on which industry can obtain labour by giving up capital for increased food production in agriculture. In this latter aspect—in which we shall call it the 'release curve' of labour—it has some obvious affinities with the familiar price- or constant-outlay lines of the theory of the firm showing the combinations of factor inputs available to an entrepreneur at given total cost.

It is clear that the greatest industrial output obtainable from the given capital stock z_0 (in the economy as a whole) will be achieved at the point M_0, where the release curve of labour is tangential to an equi-product line of industry (x_0), i.e. where the 'marginal release price' of labour in terms of capital π ($= -1/dR/dv$) is equal to the marginal rate of substitution (ratio of marginal products) between capital and labour in industrial production:

$$\pi = -1\Big/\frac{dR}{dv} = \frac{\partial F}{\partial w}\Big/\frac{\partial F}{\partial v} = F_w/F_v. \tag{2}$$

Since, by virtue of (1), $dR/dv = -dT/du = -dw/dy\ G_u$, the release price can be analysed into two components:

$$\pi = \frac{dy}{dw}\Big/G_u = y_w/G_u, \tag{3}$$

i.e. it equals the ratio of the marginal food cost of industrial labour (y_w) to the marginal productivity of capital in agriculture. Hence the optimality condition (2) may be stated as:

$$F_w/y_w = F_v/G_u. \tag{4}$$

In words: the allocation of existing capital and labour resources is optimal when the *marginal productivity* of food (the extra capital producible by feeding one more unit of food to new industrial workers) is equal to the *marginal cost* of food (the extra capital forgone by equipping agriculture for the production of one more unit of food).

In the simplest case, when the marginal food cost of industrial labour is constant ($y_w = c$), the condition merely requires the rate of substitution of labour for capital in industry to be a constant multiple of the marginal productivity of capital in agriculture:

$$F_v/F_w = 1/c\ G_u. \tag{4a}$$

It should perhaps be stressed that the position described is not necessarily the best that could be achieved from the point of view of the consumer—who might well prefer a capital allocation (say N'_0) which yielded more

food at the cost of some industrial output.† It is, however, the optimum attainable in the sense of yielding the greatest possible addition to capital, and therefore the maximum growth potential for the future.‡

The incremental capital is given by the height of the industrial production surface x_0 at the point M_0, and we may presume that the next time interval will be started with a capital stock OZ_1 ($= OZ_0+x_0$) and a new 'release curve' R_1 parallel to R_0 at the appropriate height. This produces a new 'optimum' at M_1 and a further addition to capital of x_1 units. As capital grows the release curve continues to shift upward and the successive optimum points will generate a scale line S which shows the best possible combinations of labour- and capital-inputs in industry, and hence the most desirable distribution of each period's capital output (= investment) between industry and agriculture.

Variations in Release Price and the 'Optimal' Capital Intensity

A particularly simple model emerges when the release curve of labour (R) is assumed to be straight. This will certainly be so when both the production function $G(u)$ and the 'coercive potential' $P(y)$ are linear,§ but rather less stringent assumptions will suffice if we are satisfied with straightness over a short relevant range.‖ In this case it is clear that an 'optimizing' economy should act like an entrepreneur faced with given factor-price ratios (= the release price of labour) and that the advance of industry should proceed along the familiar scale-line appropriate to that ratio.†† If we can assume, in addition, that industry shows constant returns to scale, this line of advance will be a ray through the origin and the optimal

† There is of course no reason why the consumer as such should want any capital at all, or why a central authority intent on growth should desire any food in excess of what is necessary to maximize capital accumulation. But if we endow the community with some sort of *super-ego* capable of putting intrinsic values on *both* food and capital (i.e. equipped with an indifference schedule between them), the optimality condition (4) would need to be modified to read:

$$F_w/y_w+U_y/U_x = F_v/G_u,$$

where the extra term is the ratio of the super-ego's marginal utilities (its 'marginal utility of food in terms of capital'). The left-hand side now measures what might be called the 'total *marginal benefit* of food' (i.e. the extra capital *plus* the extra utility derived from the last unit of food), and the revised condition simply states that the optimum resource allocation will be achieved when this is equated to the *marginal cost* of food.

‡ Equation (4 a) has been given by Mr. I. M. D. Little in an M.I.T. mimeographical paper, 'Some Reflections on Indian Planning'. The two derivations were arrived at independently in spite of close space-time coincidence.

§ Let $y = G(u) = au+b$ and $w = P(y) = 1/c(y-b)$, where b measures subsistence food production when no capital is employed on the land. It follows that $w = R(v) = (a/c)(z_0-v)$, where $= c/a$ is the constant release price of labour.

‖ All we need postulate is that $P_y G_u$ be constant over this range, i.e. that any tendency to diminishing marginal returns to capital in agriculture be offset by the increasing ease of collecting food from the peasants as more becomes available.

†† This, incidentally, implies that annual investment (= the output of industry) must be distributed between industry and agriculture in a constant proportion.

capital-labour ratio uniquely fixed throughout the course of events.† A simplified model of this sort is particularly well adapted to display the relationship between such crucial variables as release price, growth-rates, and capital intensity, and we therefore propose to stick to it in what follows.

If $x = F(v, w)$ is homogeneous of the first degree (constant returns to scale), we must have

$$\frac{x}{w} = \frac{F(v,w)}{w} = F\left(\frac{v}{w}, 1\right) = f(\kappa) \tag{5}$$

where f stands for average labour productivity in industry which is now a unique function of capital intensity κ $(= v/w)$, as illustrated in Fig. 3 below:

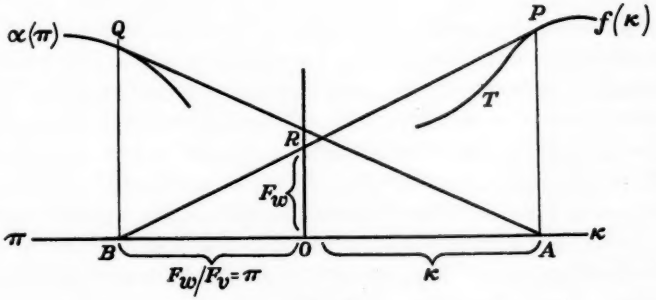

FIG. 3

As is well known, the slope of the f-curve at any point P measures the marginal productivity of capital $F_v = f_\kappa$, while the intersect of its tangent on the vertical axis (OR) gives the marginal productivity of labour $F_w = f - \kappa f_\kappa$.‡ It follows that the horizontal section OB measures the ratio of marginal productivities F_w/F_v, i.e. the release price of labour π to which the indicated capital intensity would be appropriate (optimal). Given, therefore, the release price prevailing in the economy, the optimum capital intensity for industry can always be found by drawing the tangent to the f-curve from the relevant base point B.

An interesting problem arises in connexion with the possibility, which may be open to some underdeveloped countries, to vary the release price of labour subject to specified constraints. It may be the case, for example,

† If conditions approaching perfect competition prevail in industry, the assumption of constant returns to scale is theoretically justified. The government could then seek to promote the type of optimum growth referred to by subsidizing industrial wages in such a way that the private entrepreneur is offered labour at the release price rather than at the conventional wage. It might also help planners' calculations if industrial labour was notionally valued in this way.

‡ By virtue of Euler's theorem on homogeneous functions of the first degree:

$$vF_v + wF_w = F.$$

that a portion of industry's output could be given the form of consumer goods for sale to the peasants in exchange for food, and that this would secure a greater share of any given food output for the exigencies of industrial employment than could otherwise be obtained. Alternatively, it may be possible to export a portion of the industrial output and use the proceeds to import food for industrial labour in excess of what can be procured from the peasants.† The significance of both these procedures is that a lower release price of labour (π) can be 'purchased' by reducing the share of industrial output devoted to domestic capital formation (say α), and in general it may not be too fanciful to postulate some relationship of the type

$$\alpha = \alpha(\pi) \tag{6}$$

to show on what terms such a purchase can be made. No doubt some very arduous thinking would need to be done to give flesh and blood to this relationship in particular cases, but in a theoretical paper of this kind we may content ourselves with the notion that it exists and could in principle be quantified. Some shadow of its possible substance has been plotted in the left half of Fig. 3, and this will enable us to relate the three crucial variables κ, π, and α to each other and to find the annual growth-rate of capital that will result from any of their possible conjunctions.‡

It is clear that the change in capital stock per unit time (the time-derivative of z) can be expressed as:

$$\dot{z} = \alpha x = \alpha w f(\kappa). \tag{7}$$

Further, in accordance with our special assumptions concerning the straightness of the release curve (note § on page 206) and the homogeneity of the industrial production function, we must have: $v = z - \pi w = \kappa w$, and therefore:

$$w = \frac{z}{\kappa + \pi} = \frac{f_\kappa}{f} z \quad \left(\text{since } \pi = \frac{f - \kappa f_\kappa}{f_\kappa} = F_w / f_\kappa\right) \tag{8}$$

whence it follows from (7) that $\dot{z} = \alpha f_\kappa z$, or

$$z = z_0 e^{\alpha f_\kappa t}. \tag{9}$$

† The opposite procedure would be to export a portion of domestic food output and import capital, thus freeing a part of industry for the production of incentive goods for the peasants.

‡ It seems plausible to assume that the $\alpha(\pi)$-curve is (*a*) rising, and (*b*) convex from above. A higher proportion of industrial output devoted to capital (i.e. less consumer goods) means greater difficulty in obtaining food from the peasants (i.e. a higher release price); the situation where increased production of industrial consumer goods could result in *less* food being obtainable (through a more than proportional cheapening of these goods in terms of food) belongs to the world of developed countries where farmers' demand for industrial goods could be of less than unit elasticity. The convexity of the curve means that each further increment in the proportion of industrial output devoted to capital results in progressively greater rises of the release price.

In other words, the (steady) growth rate of capital resulting from a given capital-intensity κ (in industry) is the simple product $\alpha(\pi).f_\kappa(\kappa)$, where π is related to κ in the manner illustrated in Fig. 3. It can be demonstrated that if the curvatures of α and f are as shown in the diagram, this will be maximized when κ is so chosen as to equate the ratio of ordinate to slope at the corresponding points of the two curves (P and Q), i.e.:

$$\frac{\alpha}{\alpha_\pi} = \frac{f}{f_\kappa} (= BA). \dagger \tag{10}$$

The Choice Between Competing Optima

The particular level of the capital-labour ratio which will make condition (10) come true is of considerable significance in our model; for it can be shown that, given plausible conditions, any radical departure from it will not merely reduce the speed of capital formation below the maximum attainable, but will also entail some sacrifice in the food output that could have been achieved (though this may be outweighed by greater production of industrial goods for consumption or export).

In order to demonstrate this we shall start by defining, and relating to each other, the three ultimate benefits which may be presumed to enter the developing nation's 'utility-function' when the balance of gains and losses for a given period comes to be struck. These we may take to be:

1. $Z \equiv$ the total accumulation of capital during the period $0 \to t$ which, by virtue of (9), may be written

$$Z = z - z_0 = z_0(e^{\alpha f_\kappa t} - 1). \tag{11}$$

2. $Y \equiv$ the total (cumulative)‡ food consumption enjoyed over and above the peasants' subsistence level b. This may be computed from the capital stock in agriculture, $u = z - \kappa w = zF_w/f$,§ which is assumed to

† Let $\zeta \equiv \alpha f_\kappa$. Then $d\zeta/d\kappa = \alpha_\kappa f_\kappa + \alpha f_{\kappa\kappa} = \alpha_\pi \pi_\kappa f_\kappa + \alpha f_{\kappa\kappa}$. Since $\pi = f/f_\kappa - \kappa$ and $\pi_k = -f.f_{\kappa\kappa}/f_\kappa$, this transforms into $d\zeta/d\kappa = \alpha_\pi.f_{\kappa\kappa}.(\alpha/\alpha_\pi - f/f_\kappa)$, which vanishes when (10) applies; it would also vanish at a point of inflexion like T ($f_{\kappa\kappa} = 0$), but the existence of such a point may be described as a perversity in average productivity curves. The normal extremum (10) will be a maximum if the curvatures of f and α ($f_{\kappa\kappa}/f_\kappa$ and $\alpha_{\pi\pi}/\alpha_\pi$) are both negative and their products exceeds $(f_\kappa/f)^2$. This may be shown by computing the second derivative at the extremum:

$$\frac{d^2\zeta}{d\kappa^2} = \alpha_\pi (f/f_\kappa)^2 \left[\frac{\alpha_{\pi\pi}}{\alpha_\pi}\frac{f_{\kappa\kappa}}{f_\kappa} - (f_\kappa/f)^2\right] f_{\kappa\kappa},$$

and assuming that $f_{\kappa\kappa} < 0$.

‡ We regard the period under review ($0 \to t$) as a 'time-horizon', i.e. an interval taken as the 'unit of perspective' in the sense that the time-distribution of consumption *within* it is regarded as irrelevant by the community or the planners (subsistence is of course assured throughout). It follows that Y is unaffected by time-preference or notional interest rates.

§ From (8) we have $\kappa w = z\kappa f_\kappa/f$, and therefore

$$u = \frac{f - \kappa f_\kappa}{f} z = \frac{F_w}{f} z.$$

determine food output in a linear way ($y = au+b$, see note §, page 206). Thus:

$$(12) \quad Y = \int_0^t (y-b)\,dt = \frac{az_0F_w}{f}\int_0^t e^{\alpha f\kappa t}\,dt = \frac{aF_w}{\alpha f f_\kappa} z_0(e^{\alpha f\kappa t}-1),$$

and

3. $X \equiv$ the total output of industrial products for consumption or export, which must be $100(1-\alpha)$ per cent. of total industrial output $X+Z$; hence

$$(13) \quad X = \frac{1-\alpha}{\alpha} Z = \frac{1-\alpha}{\alpha} z_0(e^{\alpha f\kappa t}-1).$$

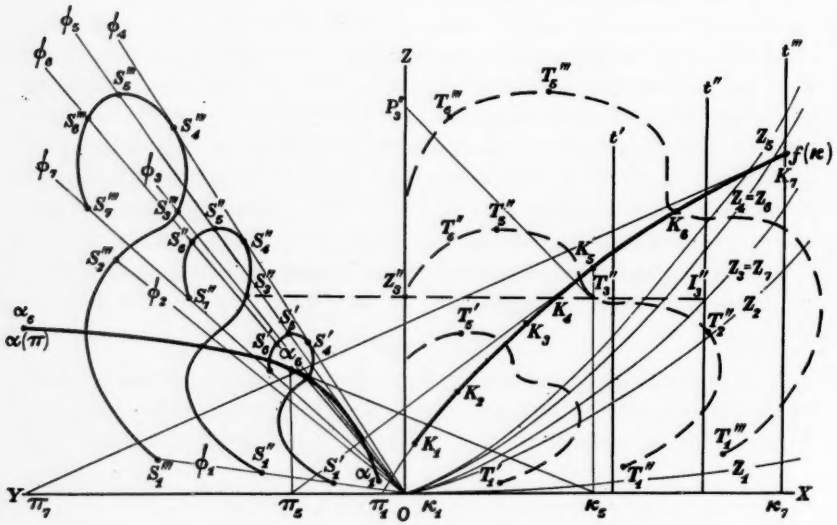

FIG. 4

The three flows X, Y, Z, related to a given time-horizon $0 \to t$, exhaust the national income becoming available outside the subsistence sector during that period. Given our simplifying assumptions (linear release curve and constant returns in industry), all three are uniquely determined by the capital intensity κ and by the share of capital goods in industrial output α (which is itself uniquely related to κ through its dependence on π—see Fig. 3). It should therefore be possible to show how X, Y, and Z develop through time for any given capital intensity that may be chosen, and this has been attempted in Fig. 4.

We shall first concentrate on the movements of Y and Z (the S-shaped

curves on the left-hand side of Fig. 4). In view of (11) and (12), we must have

$$Z = \frac{\alpha f_\kappa f}{aF_w} Y = \frac{\alpha f}{a\pi} Y \equiv \phi Y \tag{14}$$

where ϕ is the ratio of capital output to food output, which is constant for any chosen κ (α, f, and π are all functions of κ, and a is a constant). Thus, in the left half of Fig. 4 we can draw the rays ϕ_1, ϕ_2, &c. (corresponding to the capital intensities at K_1, K_2, &c.) along which the point (Y, Z) must travel as time proceeds.† It is clear, however, that it will travel at different speeds according to which ray (or capital intensity) is chosen. To measure these speeds we have reproduced the curves $f(\kappa)$ and $\alpha(\pi)$ on the diagram, as postulated in Fig. 3, and superimposed on the right half of Fig. 4 the time paths of Z (Z_1, Z_2,...) plotted against a time-scale on the horizontal axis;‡ Z_1, Z_2, Z_3, &c., are simply the functions (11) for ascending values of κ (κ_1, κ_2, κ_3, &c.). As we proceed from point K_1 on the f-curve to progressively higher capital intensities, the time path swings upwards until its highest position is reached with the curve Z_5 (corresponding to K_5); this is the maximum rate of growth for capital, αf_κ, corresponding to condition (10) and to point P in Fig. 3. Any further increase in capital-intensity, such as a movement to K_6 or K_7, will make the time path fall back to a position already occupied before (e.g. Z_6 and Z_7 are identical with Z_4 and Z_3 respectively). It is now possible, for any time-horizon we may care to select (t', t'',...), to read off the values of Z that will be achieved with various capital-intensities; we need only go up the chosen time-boundary (say t'') and measure the height of its intersections with the relevant time-path (say Z_3, intersecting at I''_3). Thus, if capital intensity κ_3 is chosen, the total capital accumulation during period $0 \to t''$ will be OZ''_3. Simultaneously we can find the food consumption of the period (Y) by plotting the points S on the corresponding ϕ-rays (in our case ϕ_3) at the height of the chosen intersection (in our case I''_3). This produces time-contours in the shape of an inverted S,§ showing the total score of capital accumulation (Z) and food consumption (Y) achieved in each given time-horizon with various capital intensities.

From the shape of these contours it is clear that if capital and food were

† The slopes of these rays have been computed by measuring each κ (the abscissa of the $f(\kappa)$-curve at the point K), ascertaining the corresponding f, π, and α (by drawing the tangent at K), and inserting the values in the definition of $\phi \equiv \alpha f/a\pi$ (a was taken as unity).

‡ The units chosen for this scale are immaterial to the outcome.

§ The reason for this somewhat overtaxes intuition (at least the author's), but may be put formally as follows: the Z-curves in the right half of the diagram rise and fall (exponentially) with the value of αf_κ while the ϕ-rays in the left half move (proportionately) with the value of $\alpha f/\pi = \alpha f_\kappa f$. Both values are functions of κ, but the latter reaches its maximum (at K_4) earlier than the former, and therefore Z continues to rise while ϕ is already falling. Moreover, at low levels of κ, Z grows faster than ϕ (making for the lower bulge in the S-curves), while at higher levels this relationship is reversed.

the only ends desired, it would hardly be worth while to adopt any capital intensity deviating markedly from the critical level κ_5 (which produces the maximum capital accumulation for every time-horizon). To stop short of this level would mean sacrificing both capital and food as we move from S_5 down to S_2, while the gains in food consumption at capital-intensities below κ_2 (at the bulge of the S-curves between S_1 and S_2) would be purchased at a disproportionate cost in capital accumulation.† To push beyond κ_5 on the other hand, would mean some immediate gain in food consumption at a slight cost in capital accumulation, but only until a position near S_6 is reached; thereafter the S-curves turn inward again, and both food consumption and capital accumulation would be lost by further increases in κ. Thus, as long as the consumption output of industry is regarded as a mere intermediate flow (to elicit food from the peasants), the capital intensity which industry should adopt will lie in the range between K_5 and slightly beyond K_6, i.e. *at* or *somewhat above* the investment-maximizing level.

The situation is, however, radically different if the consumer output of industry is also desired as an end in itself, and particularly if the growth in total industrial production (or employment) is the highest priority in its own right, regardless of the form it takes. In that case it becomes necessary to take into account the time contours of the industrial output of consumer goods X, which we have plotted against Z in the right half of Fig. 3 ($X = Z(1-\alpha/)\alpha$,‡ see (13)) The diagram now shows for any chosen time-horizon, say t'', the constellation of all three income-components (X, Y, Z) corresponding to each capital intensity. Thus, if κ_3 is selected, we need only draw the horizontal guideline from the intersection of Z_3 with $t''(I''_3)$, and immediately find the cumulative achievements in capital accumulation ($Z = OZ''_3$), food consumption ($Y = Z''_3 S''_3$), and industrial output of consumer goods ($X = Z''_3 T''_3$). Total industrial production ($P = X+Z$) is measured by the intersect on the Z-axis of a 45°-line through the point $T''_3(OP''_3)$.

It will be clear from the shape of the T-curves that the greatest possible industrial output of consumer goods would be achieved with a capital intensity below κ_2 (which would bring the (X, Z)-point to the lower bulge of the T-contours), while the maximum in *total* consumption $X+Y$ would require a capital intensity slightly below that (assuming a constant,

† It is possible for this gain to be somewhat greater than the diagram implies: if the curvature of α-curve near the origin were less pronounced, the upward swing of the ϕ-rays ($\phi = \alpha af/\pi$) would be slowed down somewhat more than that of the Z-curves, and this would cause the lower part of the S-contours to bulge out more. There is, however, a limit to this; for if Z is to have a maximum at all, the curvature at α_s must not fall below a certain value (see note †, page 209).

‡ The complexity of these curves is explained by the fact that α is a function of κ which is itself related to Z by virtue of (11).

one-to-one, valuation of industrial consumer goods in terms of food).† The greatest volume of total industrial output $X+Z$, on the other hand, would seem to require something very near κ_2 for its capital intensity, since this would bring the (X, Z) point somewhere near T_2 where the T-curve is tangential to a 45° line and produces the highest possible P-point on the Z-axis; the κ maximizing industrial employment (w) should also lie in this vicinity. The exact level of the capital intensities required for all these maxima will, however, vary according to the time-horizon within which such maximization is desired.‡ As we proceed from t' to t'' and to successively longer time-horizons, the upper bulge of the T-contours will push out faster than the lower bulge, until in the limit (for very large time-horizons) the employment-maximizing κ will be equal to the (constant) investment-maximizing capital-intensity as defined in condition (10).§

Our analysis thus seems to indicate that the conflict between investment (Z) and the other desiderata (X, $X+Y$, $X+Z$, or w) which manifests itself within short and medium time-horizons in the sharp discrepancy between the capital-intensities most favourable to them, would be mitigated, or even obliterated, if very long time-horizons were acceptable. This would give an unambiguous verdict in favour of the investment-maximizing intensity κ_5, as determined by condition (10), on all possible grounds. It seems likely, however, that this 'reconciling' time-horizon would be impossibly long, and that in practice the sharp alternative between a lower, consumption-boosting, and a higher investment-maximizing capital-intensity remains to be faced, though—as we have seen—the choice between *food*-consumption and investment (Y, Z) is not nearly as categorical as is often supposed.

We must not, however, lose sight of the original objective of industrialization which was implicitly formulated in the first paragraph of this article: There is to be a speedy movement from the historically set resource allocation (point T of Fig. 1) to the Pareto optimum as given by the contract curve LM. This implies the prescription that the 'region of waste', as

† It may be, however, that the (X, Z)-indifference schedules of the planners is such as to make them prefer a point on the upper bulge.

‡ It can be shown that the κ which maximizes industrial output $P(= X+Y)$ is defined by the condition

$$\frac{\alpha}{\alpha_w} = \frac{f}{f_\kappa}\left(1+\frac{1}{t}\frac{Z/\alpha f_\kappa}{Z+1}\right).$$

This will obviously approach the investment-maximizing κ without limit as the time-horizon is increased ($1/t \to \infty$ and $Z/Z+1 \to 1$).

§ The proposition may be demonstrated without the mathematics of the previous note by noting that the ratio Z_5/Z_1 increases very fast as we move outward on the Z-curves to higher time-horizons. The corresponding ratio of industrial outputs $P_5/P_1 = (Z_5/\alpha_5)/(Z_1/\alpha_1)$ is therefore a constant multiple of a rapidly growing figure, and must eventually exceed unity, even if P_1 started by being larger than P_5; hence P_5 must ultimately be the maximum, if only the time-horizon is large enough.

measured by the area enclosed by corresponding equi-product lines (say x_1 and y_3 in Fig. 1), should be eliminated as quickly as possible. Whether this is best achieved by maximizing the growth of capital (i.e. the rate at which the height of the box diagram expands) or the growth of industrial employment (the eastward shift of T) is impossible to determine without a knowledge of the agricultural contours y in those regions where overpopulation has been eliminated. It is, however, unlikely that this criterion would help the industrialization process for any length of time. In the first place, the equi-product lines of industry are unlikely to remain unaffected by improving technology as development proceeds; in the second place, the mere elimination of the wastes of rural overpopulation will cease to be an over-riding objective once the goal is near. As the contract curve LM moves into sight, the community or the planners will begin to be interested not merely in reaching it, but even more in landing on it in the most preferred position (product-mix). But that is a different story.

Nuffield College, Oxford

CYCLICAL FLUCTUATIONS AND ECONOMIC GROWTH[1]

By LUIGI L. PASINETTI

THE publication of J. M. Keynes's *General Theory* has been followed, especially in the Anglo-American economic literature, by a long series of macro-economic theories, or models, which have allowed their authors to present some simple explanations of two significant dynamic movements of an economic system as an aggregate: the cyclical fluctuations and the economic growth of exponential type. The task of clarifying the relation between these two phenomena has turned out to be much more difficult. Economists have not so far been able to provide a theory which accounts for both of them, and explains the economic movement of a capitalist society as it can be observed in the real world, where it conforms neither to pure cycles nor to a steady growth, but to a complex dynamic process of growth with periodical irregularities.

All models which have been presented may be classified in two groups, according as the temporal extensions from which they start, go back, roughly, to the supply aspect or to the demand aspect of the Keynesian analysis. A first group—which began with the well-known Harrod–Domar model—aimed simply at defining a hypothetical path of steady growth, externally given by the *natural* possibilities of supply of the system, and then at finding the conditions of equilibrium which the economic magnitudes must satisfy in order to adhere to that movement. A second group has had a somewhat more ambitious aim. The attention has been focused not on external data, but on some *endogenous* relations, expressing the aggregate behaviour of consumers (Keynesian multiplier) and of entrepreneurs (principle of acceleration), with the purpose of exploring the dynamic consequences of these two kinds of behaviour. By this type of analysis, various authors have come to very different conclusions. Until not very long ago they at least agreed in saying that an economic system, if left to its purely endogenous forces, is not capable of steady growth but is inevitably doomed to periodical fluctuations (such fluctuations being then interpreted in different ways).[2] Recently, however, Professor

[1] This paper is an English version of 'Fluttuazioni cicliche e sviluppo economico', published in *L'Industria*, No. 1, 1960.

[2] See, for example, R. Frisch, 'Propagation Problems and Impulse Problems in Dynamic Economics', in *Economic Essays in Honour of Gustav Cassel*, London, 1933; M. Kalecki, 'A Macro-dynamic Theory of Business Cycles', in *Econometrica*, 1935; N. Kaldor, 'A Model of Trade Cycle', in *Economic Journal*, 1940; V. Marrama, 'Short Notes on a Model of the Trade Cycle', in *The Review of Economic Studies*, 1946–7; J. R. Hicks, *A Contribution to the*

Duesenberry[1] has presented a purely endogenous model which nevertheless produces a steady growth.

The time has come perhaps to inquire more deeply into this problem, which is what I propose to do in part I of the present paper, where the properties of an endogenous dynamic model, more general than those so far analysed in post-Keynesian literature, will be patiently examined, with the help of a mathematical appendix. The model will enable us to explore not only the different dynamic movements which may follow from the interaction between the multiplier and the principle of acceleration, but also the consequences to the stability of the system deriving from the interrelations between the movements of income and those of the stock of capital.

A theoretical framework of this type will then make it possible to present, in part II of the paper, the various macro-economic theories so far proposed as particular cases of it.

This will allow us to single out the reasons why all these theories, though able to give separate explanations of a cyclical movement or of a growth movement, are unable to explain both phenomena together. Such reasons, which will turn out to be deeply connected with the macro-economic character of these models, will lead in the last section of the paper to outline a type of analysis of a more disaggregated nature, which—I hope—may help to shed new light on the whole complex and intricate problem of the relation existing between economic growth and cyclical fluctuations.

I

1. The Model

Let us begin our analysis by an investigation of the dynamic behaviour of total effective demand in an economic system. We shall use for the purpose the following theoretical model:

$$K_t \equiv K_{t-1}+I_t, \tag{1}$$

$$Y_t \equiv C_t+I_t, \tag{2}$$

$$C_t = aY_{t-1}, \tag{3}$$

$$I_t = \alpha Y_{t-1}-\beta K_{t-1}, \tag{4}$$

where I = total net investment, C = total consumption, Y = total effective demand, or total net income, K = stock of capital at the end of the period under consideration, t = period of time which the variables refer to. The variable K represents a *stock* at the end of period t; all other variables express *flows* which take place during the period.

The system (1)–(4) is made up of four equations in four variables and

Theory of the Trade Cycle, Oxford, 1950; R. M. Goodwin, 'The Non-Linear Accelerator and the Persistence of Business Cycles', in *Econometrica*, 1951.

[1] J. S. Duesenberry, *Business Cycles and Economic Growth*, New York, 1958.

is of a purely *endogenous* character. Equations (1) and (2) are identities; (3) represents total consumption as a simple linear function of income, where $0 < a < 1$; and (4) expresses total net investment as a linear positive function of income and a negative function of the stock of capital (so that $\alpha > 0, \beta > 0$).

Following a convention which is common to all cycle models, we shall interpret all variables in terms of *deviations* (positive or negative) from their values corresponding to the *stationary state*, intending by stationary state that situation where there is no net investment and total net income is equal to total consumption. In graphical terms this situation corresponds to the point where the Keynesian consumption function intersects the 45° line through the origin. This, by the way, has permitted us to write (3) in homogeneous terms (namely, without the constant term which normally appears in a Keynesian consumption function).

2. An Interesting Graphical Device suggested by Professor Duesenberry

Model (1)–(4) is more general than those of Samuelson and of Hicks[1] because the investment function has been based on a more general form of the acceleration principle. In fact, we may write equation (4) as follows:[2]

$$I_t = \beta\left(\frac{\alpha}{\beta}Y_{t-1} - K_{t-1}\right), \tag{4 a}$$

where α/β may be interpreted as the ratio that entrepreneurs desire to keep between the capital stock and production per unit of time, and β as the reciprocal of the number of periods over which entrepreneurs tend to distribute their investment whenever they find that the quantity of existing capital differs from the quantity which they desire to have.[3]

The model coincides, instead, with the one which has been adopted by Duesenberry in his latest book,[4] except for a few unimportant modifications. Duesenberry uses a device which is worth considering immediately. In terms of our model, he substitutes (1)–(2) into (3)–(4) and writes:

$$\frac{Y_t - Y_{t-1}}{Y_{t-1}} = (\alpha + a - 1) - \beta\frac{K_{t-1}}{Y_{t-1}}, \tag{5}$$

$$\frac{K_t - K_{t-1}}{K_{t-1}} = -\beta + \alpha\frac{Y_{t-1}}{K_{t-1}}. \tag{6}$$

[1] P. A. Samuelson, 'Inter-Action between the Multiplier Analysis and the Principle of Acceleration', in *The Review of Economic Statistics*, 1939; J. R. Hicks, op. cit.

[2] In the particular case in which $\beta = 1$, equation (4 a) reduces to the simple acceleration principle adopted by Samuelson and Hicks.

[3] On this subject: R. M. Goodwin, 'Secular and Cyclical Aspects of the Multiplier and the Accelerator', in *Income Employment and Public Policy: Essays in Honor of A. H. Hansen*, New York, 1948; H. B. Chenery, 'Overcapacity and the Acceleration Principle', in *Econometrica*, 1952.

[4] J. S. Duesenberry, op. cit.

By now calling $r_y = \frac{Y_t - Y_{t-1}}{Y_{t-1}}$; $r_k = \frac{K_t - K_{t-1}}{K_{t-1}}$; $v = \frac{K_{t-1}}{Y_{t-1}}$, (5)–(6) become:

$$r_y = (\alpha + a - 1) - \beta v, \tag{7}$$

$$r_k = -\beta + \alpha \frac{1}{v}, \tag{8}$$

which express the proportional rates of growth of income and capital (r_y and r_k) as linear functions of the capital-output ratio (v), or of its reciprocal. These two equations can be represented graphically on a single diagram with the rates of growth on the ordinate and the capital-output ratio on the abscissa. The first equation is a straight line intercepting the ordinate at $(\alpha + a - 1)$ with a negative slope $-\beta$. The other equation is a rectangular

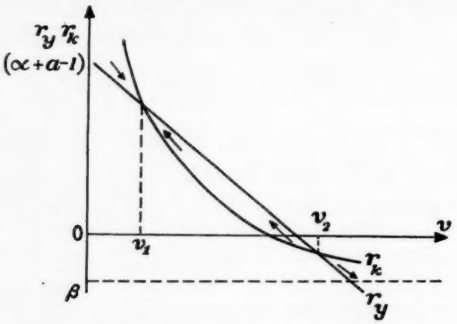

FIG. 1

hyperbola. Duesenberry always represents it[1] *as if* its asymptotes were the abscissa and the ordinate but his diagrams are not correct. Equation (8) is indeed a rectangular hyperbola but only one of its asymptotes coincides with an axis (the ordinate). The other asymptote is a straight line parallel to the abscissa and displaced downwards by a distance β (see Fig. 1). The diagram immediately suggests that curves (7)–(8) may not cross each other, or, if they do, they present two points of intersection (except in the limiting case when they are tangential and have therefore a single point in common). Therefore, in the case in which they cross each other, there are two values of the capital-output ratio—indicated by v_1 and v_2 in Fig. 1—at which the proportional rate of growth of income is equal to the proportional rate of growth of capital. It appears from Fig. 1 that the rates of growth of income and of capital will change from one period to the next, unless the system is exactly in one of the two positions where the capital-output ratio is either v_1 or v_2. Of these two positions, however, only the first one fulfils the conditions for a stable dynamic equilibrium; position v_2 is unstable,

[1] J. S. Duesenberry, op. cit., pp. 205, 211, 220.

in the sense that even if we suppose that the system may get there by chance, it will again diverge from there as soon as it is slightly displaced.

With a theoretical apparatus of this type, Duesenberry is able to affirm, contrary to all previous economists who elaborated endogenous theories of fluctuations, that an economic system which is governed by the multiplier-accelerator mechanism is capable of growing steadily. There are, however, two cases in which steady growth may be prevented: (i) when the parameters are such that the two curves (7)–(8) do not cross each other, and (ii) when, although the two curves cross each other, the system starts from a position in which the capital-output ratio is higher than v_2. Duesenberry excludes the first case from his analysis and focuses his attention exclusively on the second. He then tries to explain all the depressions of the United States economy in the last 100 years by looking for causes which are specific to each of them, and which have produced such shocks as to displace the system beyond its limits of stability.

Duesenberry does not realize, however, that the model under consideration is more general than appears from his diagrams. He simply ends up by considering only one of the many possible cases. His error in representing the equations graphically prevents him from seeing that curves (7)–(8) could as well cross each other in the negative quadrant (negative rates of growth). Moreover, he does consider the case in which the two curves do not intersect—as pointed out above—but he dismisses it too quickly.[1] As a matter of fact, this case exactly corresponds to the situation on which the whole previous economic literature has relied in order to explain the regularities of business cycles. To demonstrate this proposition, we must now abandon Duesenberry's analytical tools, which are no longer sufficient for the purpose, and turn to an explicit solution of the difference equations resulting from the model we are considering.

3. The Dynamics of Income

Let us go back to the system of equations (1)–(4) and let us substitute (1)–(2) into (3)–(4). We obtain:

$$K_t - K_{t-1} = \alpha Y_{t-1} - \beta K_{t-1}, \tag{9}$$

$$Y_t = (\alpha + a) Y_{t-1} - \beta K_{t-1}. \tag{10}$$

An expression for K immediately emerges from (10), i.e.

$$K_{t-1} = \frac{\alpha + a}{\beta} Y_{t-1} - \frac{1}{\beta} Y_t. \tag{11}$$

[1] He simply expresses the view that this case is unlikely to happen. He explains it shortly by saying that 'given appropriate initial conditions, income may grow at first' but will eventually stop rising and cause a depression, during which there is capital decumulation. He concludes that 'there appears to be no example of that type of depression'. J. S. Duesenberry, op. cit., pp. 236 and 332.

By subtracting (9) from (10) and simplifying, we have

$$Y_t - K_t + K_{t-1} = aY_{t-1},$$

where the K's may now be expressed in terms of the variable Y, by using (11). Substituting and simplifying, we finally obtain

$$Y_t = (\alpha+a+1-\beta)Y_{t-1} - (\alpha+a-a\beta)Y_{t-2}. \tag{12}$$

This expression contains the parameters of both the consumption function and of the investment function, and therefore expresses the joint effect of these two relations (multiplier-accelerator mechanism) on the dynamics of income. It belongs to a family of equations that mathematicians call homogeneous, second order difference equations, and its general solution takes the following form:[1]

$$Y_t = A_1 x_1^t + A_2 x_2^t, \tag{13}$$

where A_1 and A_2 are two arbitrary constants and x_1, x_2 are the roots of the quadratic equation

$$x^2 - (\alpha+a+1-\beta)x + (\alpha+a-a\beta) = 0 \tag{14}$$

namely

$$x_{1,2} = \tfrac{1}{2}(\alpha+a+1-\beta) \pm \tfrac{1}{2}\sqrt{\{(\alpha+a+1-\beta)^2 - 4(\alpha+a-a\beta)\}}. \tag{15}$$

Evidently, as t increases in (13), the movement of Y over time depends on the constants A_1, A_2 and on the nature of the roots x_1, x_2. Leaving to section 5 an examination of the meaning of the constants, and supposing here that they are positive, let us concentrate on the roots x_1, x_2.

From (15) it appears that x_1 and x_2 may be either real numbers or complex numbers, according as to whether the term under the square root is positive or negative, which depends on the values of the parameters α, β, a. If x_1 and x_2 are real numbers, the behaviour of Y, after a few periods, will practically be dominated by that term in (13) which contains the larger of x_1, x_2 in absolute value. If x_1 and x_2 come out as complex numbers, (13) becomes more difficult to interpret. However, it can be transformed (see the mathematical appendix) in such a way as to obtain an expression, containing only *real* terms, of the following form:

$$Y_t = B\rho^t \cos(t\theta + \epsilon), \tag{16}$$

where the cos term represents the trigonometric function cosine; B, ϵ are two arbitrary constants, and ρ, θ are two coefficients deriving from a particular combination of the parameters of equations (3)–(4).

Expressions (13) and (16), in their general formulation, are not enough, however, to provide a complete picture of all the possible dynamic movements of Y, because such movements may be of very different natures

[1] See, for example, W. J. Baumol, *Economic Dynamics*, New York, 1951; R. G. D. Allen, *Mathematical Economics*, London, 1956, ch. 6.

according to the values assumed by the parameters which enter into the expressions. To find out the properties of all these possible movements, a long and patient examination is required, which has been developed in a mathematical appendix at the end of the paper. The conclusions, however, will be given here.

First of all, in order that there may exist any possibility of growth at all, a necessary condition is

$$\alpha > 1-a, \tag{17}$$

which means that—for any given amount of capital—the marginal propensity to invest, as income increases, must be higher than the marginal propensity to save. If α were smaller than $(1-a)$, the system would never be able to depart permanently from a situation of zero savings. In terms of Fig. 1, (17) means that the straight line must cut the ordinate in the positive range. Furthermore, another condition has to be imposed in order

TABLE I

Case no.	*Range of values for* β	*Type of roots*	*Time paths of Y and K (on the assumption* $A_1 > 0$*)*
1	$0 \leqslant \beta \leqslant (\alpha+1-a)-2\sqrt{\{\alpha(1-a)\}}$	Real, positive, greater than one	Exponential positive growth
2	$(\alpha+1-a)-2\sqrt{\{\alpha(1-a)\}} < \beta < \frac{\alpha+a-1}{a}$	Complex, with modulus (ρ) greater than one	Regular cycles of continuously increasing amplitude (*explosive*)
3	$\frac{\alpha+a-1}{a} < \beta < (\alpha+1-a)+2\sqrt{\{\alpha(1-a)\}}$	Complex, with modulus (ρ) smaller than one	Regular cycles of continuously decreasing amplitude finally dying out at zero (*damped*)
4	$(\alpha+1-a)+2\sqrt{\{\alpha(1-a)\}} \leqslant \beta < (\alpha+a+1)$	Real, positive, or one positive and one negative, smaller than one in absolute terms	Steady convergency towards zero (i.e. negative rate of growth)

to rule out the possibility of some very peculiar behaviour of the system, contrary to any past or foreseeable experience. The condition is

$$\beta < \alpha+a+1, \tag{18}$$

and is practically always satisfied, as can be realized by remembering the meaning of β given at the beginning of section 2, and considering that a is slightly less than one. In fact, condition (18) comes roughly to saying that the time lag with which capital (by new investment) tends to be adapted to changes in income must not be less than a half of the time lag (which is of one period) with which *consumption* is adapted to the same variation of income—a condition whose non-fulfilment is very difficult to conceive.

When (17) and (18) are satisfied, the movement of income over time may be of any of four different types which can be classified according to the range of values in which the parameter β falls relatively to the other parameters. The properties of these four types of behaviour are summarized in Table I, and are separately illustrated by Fig. 2, to which the reader is now referred.

An interesting sub-case may be added to the four cases shown, as a limiting possibility between cases 2 and 3, when β is exactly equal to $(\alpha+a-1)/a$, and fluctuations maintain therefore not only a constant length but also a constant amplitude as time goes on.

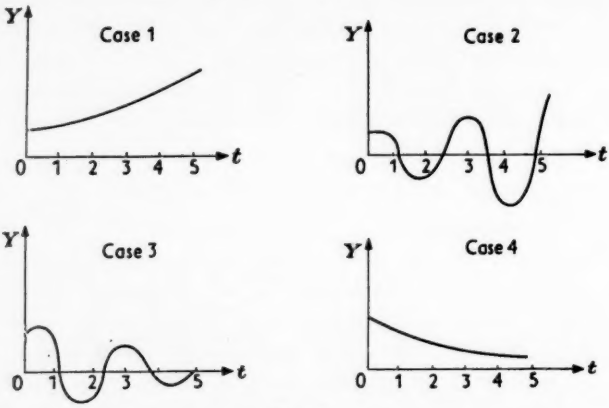

FIG. 2

The different types of dynamic behaviour which are described in Table I and illustrated in Fig. 2 synthesize in themselves the essential characteristics of all relevant cases which the endogenous mechanism of the multiplier-accelerator may call into being.[1] We shall now have to examine the interpretative value of these types of behaviour, but, before doing that, we must widen our analysis to inquire also into the possible dynamic movements of the stock of capital.

4. The Dynamics of the Stock of Capital

As a consequence of the dynamic movement of that part of effective demand which refers to investment, the quantity of capital also changes in time, as income changes. In the foregoing section we have already obtained for capital equation (11), which expresses K in terms of Y, namely in terms of the variable of which we have studied the dynamic behaviour.

[1] The reader who is acquainted with the literature on dynamic economics will notice the similarity of the results which appear in the fourth column of Table I with those which emerge from the studies by Samuelson (op. cit.) and Hicks (op. cit.) on the interaction between the multiplier and the acceleration principle.

By now substituting (13) and (16) successively into (11), the following two expressions emerge:

$$K_t = v_1 A_1 x_1^t + v_2 A_2 x_2^t, \tag{19}$$

$$K_t = B\gamma\rho^t \cos(t\theta + \epsilon - \eta), \tag{20}$$

which allow us to analyse the dynamic movement of K in the case in which x_1 and x_2 are real and in the case in which they are complex, respectively.

As can be seen immediately, (19) and (20) are similar to (13) and (16), the only difference being that they contain some more constants: v_1, v_2, γ, η. The possible movements of K over time are therefore of the same type as those of Y, corresponding to the same ranges of values for β. They only differ by some fixed proportions [owing to constants v_1, v_2 in (19), and γ in (20), all of which are shown to be positive in the Appendix], and moreover by the constant η in (20) which causes the fluctuations of capital to have a time lag of a fraction of a period (η/θ) relative to the fluctuations of income.

5. Inter-relations between the Dynamics of Income and the Dynamics of Capital

Our analysis has been carried on so far without inquiring into the meaning of those magnitudes which we have called 'arbitrary constants'—A_1, A_2, and B, ϵ, in the case of real solutions and in the case of complex solutions respectively. We have simply assumed that these constants are positive. Now, in the case of complex roots such an assumption has really no relevance because the signs of B and ϵ, whatever they may be, do not modify qualitatively the dynamic behaviour of Y and K already described, as can be seen at once by inspecting (16) and (20). In the case of real solutions, however, the problem becomes more complicated and needs a deeper examination. This will also allow us to give a more rigorous meaning to the cumulative processes which already could be inferred from the graphical representation of Fig. 1.

The constants A_1 and A_2 have been called 'arbitrary' because they may be chosen arbitrarily in the solution of (11) and (12). This enables us to introduce in our problem two more *data*, and we may choose total income and total capital at period zero (Y_0 and K_0—initial conditions of the system). By now putting $t = 0$ in (13) and (19) and solving for A_1 and A_2, we obtain (see the mathematical appendix for details):

$$A_1 = \frac{v_2 Y_0 - K_0}{v_2 - v_1}, \tag{21}$$

$$A_2 = \frac{K_0 - v_1 Y_0}{v_2 - v_1}, \tag{22}$$

where A_1 and A_2 are expressed in terms of the initial conditions (Y_0, K_0)

and of the constants v_1, v_2. The last two constants come from a well-defined combination of the parameters of the system and it is shown in the Appendix that they are both positive and that they correspond exactly to the v_1 and v_2 of Fig. 1. Moreover, v_2 is always greater than v_1. Now, of the two constants A_1 and A_2, only that one which is associated with the higher root among the x_1, x_2 becomes relevant because, as t increases, the term containing the higher x in (13) and (19) will become greater and greater with respect to the term containing the lower x and will dominate it after a few periods. Since the higher root in absolute value, within the limits in which we are interested, is always x_1, then A_1 becomes the single constant which is relevant and which we must examine in detail.

Now, (21) shows that, as $v_2 > v_1$, A_1 is positive or negative according as K_0/Y_0 (the ratio of initial capital to initial income) is smaller or greater than v_2. This gives a paramount importance to the initial conditions and to the constant v_2, which comes in this way to represent an important critical value of the capital-output ratio. A radically different behaviour of the system corresponds to the two cases in which A_1 is positive ($K_0/Y_0 < v_2$), or negative ($K_0/Y_0 > v_2$). If the system starts with a capital-output ratio smaller than v_2, income and capital move through time in the normal way described in the previous section. But if, as an initial condition or as a result of any external 'shock', the capital-output ratio turns out to be greater than v_2, the constant A_1 becomes negative and the dynamic paths of Y and K, as t increases, emerge as very different from those shown in the last column of Table I. More precisely, a negative A_1—as appears from (13) and (19)—causes a negative cumulative movement in case 1 and a movement of convergency towards zero, but from the negative side, in case 4. Our analysis, however, can help us very little in these cases because it has been developed in order to determine what will happen *eventually* (as t increases), while the system will never allow its endogenous forces to operate freely after a few periods. Indeed, after a while during which income and capital are decreasing, some external elements—such as limits to contraction of consumption, to decumulation of capital, &c.—soon check the endogenous dynamism of the system, and the interpretative value of our equations breaks down. The only thing the model can tell us, therefore, when $K_0/Y_0 > v_2$, is that the system is driven towards a slump. Without being able to indicate what will happen then, the model shows, moreover, that capital and income will not resume growth until their proportion is reduced below v_2.

By looking finally at the relative behaviour of income and capital in time, an interesting meaning also emerges for the other constant, v_1. Once more I must refer the reader to the mathematical appendix for a rigorous demonstration, but the result can be stated simply by saying that, in the

case in which the system is capable of growing, income and capital tend asymptotically to a very definite proportion as time goes on, which exactly corresponds to v_1. The result is valid wherever the system starts from (excluding of course, from the interpretation, values of K_0/Y_0 greater than v_2) and proves that the growing system is stable within a certain range. In other words, it shows that, when the conditions for an endogenous steady growth are satisfied, the system is capable of absorbing external 'shocks' in the sense that it tends to reproduce its equilibrium proportions whenever it is displaced from them, provided that the displacement does not upset the system beyond a certain critical value, which is represented in our case by a ratio of capital to income equal to v_2.

At this point I shall stop the analytical inquiry into the properties of the system of equations stated at the beginning of section 1. The results so far obtained are more than sufficient for the purposes of the present paper.

II

6. The Various Interpretations of the Endogenous Dynamics of an Economic System

The investigation which has been patiently carried out in the Appendix and summarized in the foregoing sections has by now placed us in a convenient position for putting into a single framework the various macrodynamic theories of business cycles which have appeared during the last 30 years.

All these theories have the common feature of being based on an endogenous dynamism resulting from the interaction between the Keynesian multiplier and some form of acceleration principle. The latter may be framed in a number of ways but the results are always the same. According to the range of values in which the parameters of the investment function fall, the system produces four main types of behaviour: exponential growth, explosive cycles, damped cycles, steady contraction; to which the possibility of constant cycles may be added as a limiting case between the second and the third types of behaviour. The case of steady contraction has been unanimously dismissed as contrary to common experience; different authors have then reached different conclusions simply by taking up in turn one of the other possible outcomes of the same theoretical model.

The early theories (Frisch, Kalecki[1]) relied on that range of parameters which produce damped fluctuations. In order to explain, then, the persistence of cycles, a theory was added about external and erratic 'shocks' which come continuously to stir up a cyclical movement which otherwise would slowly die out. The choice of the values of the parameters was based

[1] The works which are referred to here and in the following sections are those which have been already mentioned.

on the commonsense proposition that a system cannot get permanently away from its equilibrium position. What passed unnoticed, however, was the arbitrary association of the *equilibrium* position with the stationary state.

A similar line of thought characterizes a second type of theories (Kaldor, Marrama, Goodwin) which concentrated on regular fluctuations of neither explosive nor damped type. In order to avoid reliance on fortuitous coincidences, the persistence of cycles was explained in this case with the help of non-linear functions changing the behaviour of investments (in a continuous or discontinuous way) as the system goes farther and farther away from its equilibrium position.

Professor Hicks went a step farther. While keeping the assumption of linearity, he focused his attention on the case of explosive fluctuations, presenting them as 'constrained' by a 'floor', set by physical limits to contraction (gross investments cannot become negative), and by a 'ceiling', determined by the *natural* possibilities of the system to grow; a concept which meanwhile had happily made its appearance in economic analysis.[1] In this case too, the disregard of the growth range was based more on the emotional appeal of the impossibility of an 'explosive' system than on convincing arguments. But the terminology itself comes to be misleading in this context because a growing system is indeed 'exploding', i.e. moving away, if we take the stationary state as a term of reference. The problem, of course, does not lie in the 'explosion' as such, but in whether it takes place at a reasonable rate, namely at a rate that can be coped with by the natural increase of population and of technical knowledge.

Finally, Duesenberry has lately concentrated on that range of the parameter which produce endogenous and steady growth. In this case exclusion of regular fluctuations has come about in a more complicated and not at all clear way. It must be said, however, that Duesenberry has introduced something new in this type of analysis, namely the simultaneous treatment of the dynamics of capital side by side with the dynamics of income. This has drawn attention to the relevance of the initial conditions from which the system may start after any external shock.

At this point the range of possibilities offered by the endogenous mechanism of the multiplier-accelerator seems to have been exhausted. Indeed, it is interesting to look, *ex-post*, at all this theoretical development. But it is also surprising to realize that, although the various authors have implicitly shown well-defined preferences for some particular values of the parameters of the investment function, they have not developed an explicit discussion to justify their positions.

[1] The concept was coined by Roy Harrod (*Towards a Dynamic Economics*, London, 1948).

7. The Possibility of a Steady Growth

An interesting discussion—the only one to my knowledge—on the probability that the behavioural parameters of an economic system may fall in one or the other of the various mentioned intervals has been developed by Sidney Alexander,[1] and it seems to have been rather neglected by trade-cycle economists. Alexander starts from Samuelson's previous study[2] and, after a long analysis, he comes to the conclusion that the behavioural parameters which produce a steady growth are possible but not very probable, because they would entail rather high rates of growth of the system, unless the propensity to consume is close to unity. His analysis, however, is carried on in terms of an investment function based on the simplest version of the acceleration principle (see our discussion at the beginning of section 2), and, although the author then drops the rigid hypotheses he starts from, he always remains linked to that frame of reference. Most of all, he is impressed very much by the value of the capital-output ratio which may be observed in an economic system as a whole. Now, there is no reason to suppose that an investment function which represents the behaviour of entrepreneurs in response to *variations* of income should necessarily be based on proportions which are observed in the average of the system.

Our analysis, which has been developed with a more general and flexible version of the acceleration principle, now puts us in a better position to evaluate the problem. A short discussion has been carried out on the subject in section 13 of the mathematical appendix. It is there shown that, for any predetermined value of the propensity to consume and for any predetermined rate of growth of the system, there always exists a couple of non-negative values of the two parameters of the investment function; in other words, there always exist an α (expressing the marginal response of entrepreneurs to a variation of income) and a $1/\beta$ (i.e. a number of periods for the tendency to spread investment over time) such as to lead the system to a path of exponential growth at a rate of change which is equal to the predetermined one. That is to say, at least as far as the dynamic movement of *effective* demand is concerned, there is no path of exponential growth, at a large or small rate of change as we choose, that cannot be reached, provided that entrepreneurs adapt their behaviour (i.e. parameters α and β) to it.

From a formal point of view, the theorists of economic growth who have elaborated macro-dynamic models belonging to the first group mentioned in the introductory note, have followed a procedure which is very similar to the way of reasoning just hinted at. Taking as a reference the Harrod

[1] S. S. Alexander, 'The Accelerator as a Generator of Steady Growth, in *The Quarterly Journal of Economics*, 1949.

[2] P. A. Samuelson, op. cit.

model—which has been the starting-point for all the others—we can see that the procedure has been to define first a path of growth made possible by external elements (population increase and technical progress), and then to find out the conditions that the behavioural endogenous functions of the system must satisfy in order that the path of growth externally defined may be adhered to. That does not imply that the externally defined path of growth should necessarily be reached as an effect of the endogenous forces.[1] The problem is really left open. Indeed, the theoretical construction we have accurately analysed does not contain any mechanism which may entail that the parameters expressing the behaviour of the system should fall in the exponential growth interval or in any one of the other intervals.

We may draw the conclusion, therefore, that no reason emerges, from a pure examination of the multiplier-accelerator dynamic process, for preferring the one or the other of the proposed interpretations of the economic dynamics which have been based on it. The question is not even likely to be settled by empirical tests. Not only are there many practical difficulties in associating real movements to one or to the other type of behaviour; but moreover it will never be possible to observe a whole economic fluctuation as it would come out from the purely endogenous behaviour of the system, because any government by now—progressive or conservative as it may be—is inevitably bound to make some sort of intervention any time it is faced with a depressive movement.

8. The Difficulties of Providing a Theory which may Explain Both Cycles and Growth

The state of indeterminateness of the theoretical construction which has emerged at the end of the foregoing section, contains in itself, as a particular consequence, the difficulties already hinted at, of presenting a theory which may explain both fluctuations and growth. The situation is that, on the one hand, the macro-economic models which provide a cyclical interpretation of the economic activity cannot give any explanation of economic growth, and on the other hand, those theories which define, or rely on, the conditions for a dynamic equilibrium to be reached and maintained cannot give an explanation of business cycles.[2]

From a theoretical point of view, the situation would not be so unsatisfactory if the two phenomena—which yet are so obviously interconnected in their real manifestations—could be explained by two different

[1] As a matter of fact, in Harrod's theory (op. cit.) the *natural* equilibrium growth path is unstable, in the sense that the behaviour of entrepreneurs is such as to drive the system away from it.

[2] A brilliant criticism of this weak aspect of the present theory can be found in N. Kaldor, 'The Relation of Economic Growth and Cyclical Fluctuations', in *The Economic Journal*, 1954.

theoretical models to be combined and integrated. But the problem is just that these two models, as they flow from the previous theory, cannot be combined, because they are based on different hypotheses about the same dynamic mechanism, and therefore they are mutually exclusive.[1]

Let us not be misled on the subject by the way in which the various authors have tried to avoid the problem. Indeed, almost all trade-cycle theorists, after developing their theories with reference to a stationary state, have pointed out that the cyclical mechanism would remain the same if, in the place of a stationary state, a rising trend were introduced. The trouble is that this *trend* cannot be explained by the same theory and, therefore, has to be introduced *ad hoc*—it has to be accepted as given, or justified with supplementary arguments of a nature which must be different from or independent of the previous theory. These justifications might quite well be plausible, but the point is that they have to be accepted as such and cannot be derived from the previous theory. If we want to use such a theory in order to explain the trend, the theory can no longer explain the cycle. The theoretical framework under consideration can only give two explanations which are alternative and therefore incompatible with each other.

In an analogous but opposite way, the problem has been faced by the theorists of growth,[2] and Duesenberry provides a clear example of it. The same behavioural dynamic mechanism which has been used by the previous authors in order to explain the cycles is used in this case in order to explain growth, by relying on different values of the parameters. In so doing, of course, one can no longer explain cycles and therefore the only thing that remains is to rely on a periodical non-satisfaction of the conditions of steady growth, by supposing that some external causes bring about some sort of interruption. The procedure emerges, therefore, as exactly symmetrical to the one considered above. The same identical dynamic process resulting from the interaction between the multiplier and the accelerator is used, but it is used in order to explain a steady growth. Then, some *ad hoc* interruptions of such a movement are introduced, which are accepted as given or justified by supplementary explanations.

9. A More Flexible Use of Macro-economic Models

Returning now to our main trend of thought, we may notice that the starting-point of all criticisms which have been developed in the foregoing

[1] I shall point out that, from this point of view, the macro-economic models under consideration are even less satisfactory than some of the previous theories. For example, in Schumpeter's analysis, the problem outlined in the text does not arise at all, as his theory is such that economic growth can come about only through fluctuations (J. Schumpeter, *The Theory of Economic Development*, Cambridge, Mass., 1934; and *Business Cycles*, in 2 volumes, New York, 1939).

[2] As a matter of fact, most of the theorists of economic growth, and especially the most recent ones, have not insisted so much on cycles, being aware of the difficulties of giving a satisfactory explanation.

sections may be essentially reduced to one point, namely to the excessive degree of confidence that all authors mentioned have ended up by putting in the investment function, whose parameters are responsible for a radically different behaviour of the system according to the range of values they fall in. This is surprising because no economist would be prepared to rely very much on the stability over time of these parameters, which are well known as particularly sensitive to any kind of simple variations in entrepreneurial expectations.

Now, if the parameters expressing the behaviour of entrepreneurs in their decisions to invest are bound to assume different values in time, the situation certainly cannot be solved—as trade-cycle and growth theorists have practically done—by choosing arbitrarily particular values of such parameters and then carrying on one's analysis on the assumption that such values remain constant. If such values do change, we cannot but accept the fact, and go on to a more flexible interpretation of the whole problem.

In fact, there is no reason to suppose that the aggregate behavioural parameters, as time goes on, may not fall from the growth range into the fluctuation range, owing to very different causes, and later come back again on a (presumably different) growth path. In this way the various macro-economic models may help us to understand what happens in the real world corresponding to certain particular conditions of entrepreneurial behaviour. If, in addition to this, we consider the natural limitations to growth and the possibility of external 'shocks', we obtain a rather comprehensive view of possible movements corresponding to the various ranges of values within which the initial conditions and the parameters of the investment function may fall.

This is the maximum point to which the macro-economic theories can take us. In this way, however, they come to pose a big problem; the problem of providing a theory which explains the change of the parameters themselves and of the initial conditions which enter into the theoretical framework under consideration. But this is a problem which cannot be solved in the context of a macro-economic analysis, owing to the inherent character of the approach which has been taken. Indeed, in a mathematical formulation, *variables* and *parameters* are taken respectively to denote quantities which are varying and have to be explained, and quantities which are supposed to be constant and given. Now, if we come to the conclusion that the parameters themselves are changing, then our initial set of assumptions is evidently no longer sufficient.

In our case, if we want to inquire into the causes of variation of those quantities which represent the behavioural parameters of the investment function, we have to widen the theoretical construction from which we started. This means that we have to abandon the macro-economic approach

and push our analysis more deeply behind the aggregate parameters themselves, in order to inquire into their *composition* and in order to single out the different causes—if there are any—which are acting separately on their components.

10. A Reinterpretation of the Complex Dynamics of a Modern Economic System

The task just outlined at the end of the previous section appears so complex that I do not pretend to deal with it exhaustively in a few pages. It is my intention to come back to it at length later on. I shall give here, however, the essential lines along which I propose to develop a type of analysis which may lead to a new interpretation of the whole complex dynamics of a modern economic system.

To begin with, we may put the theoretical task just sketched out in different terms, namely in terms of a need to overcome the limitations entailed by the macro-economic analysis as such. What is alluded to here is the meaning itself of the macro-economic variables which have been used in all previous analyses. Evidently, in order that the use of such variables may be legitimate, they must measure homogeneous quantities over time. Now, the homogeneity condition would be satisfied if the various total quantities were always composed by the same goods in the same proportions as time goes on; in other words, if the total quantities could be considered as measured in terms of a composite unit, or 'basket of goods' of a constant composition through time. The use of macro-economic variables in a dynamic analysis amounts precisely to an implicit acceptance of this hypothesis, the meaning of which—in a process of economic growth—comes down to the assumption that demand is expanding in a proportional way, namely that it is being distributed among the various goods in such a way as to maintain among them the same proportions in time.

An assumption of this type might perhaps come to be close to reality in the case in which the growth possibilities were confined exclusively to increases of population, with ideal constant returns to scale, no change of tastes and no technical progress. But in such a case, the problem of adapting the behaviour of investments to the potential physical growth of the system would not be difficult to solve. It is true that all movements we have considered would still be *theoretically* possible. However, entrepreneurs would be faced with a situation in which individual incomes and preferences remain constant through time and they would find them out sooner or later. From that point on, the only possibility which we can reasonably expect is that of a steady growth. In other words, given such a hypothetical case, entrepreneurs might make mistakes or have some hesitations at the beginning, with the effect of causing some fluctuations, but after

a few cycles they would certainly find out the individual preferences (which remain unchanged through time); that is to say, they would quickly *learn* the behavioural parameters which lead to an equilibrium growth (compatible with the increase of population).

The problem, of course, is that we do not live in a world of this type, as economists, after all, have always been aware. Whether we take the 'classic' view of limited resources and diminishing returns to scale, or the more modern view of technical progress developing new resources and reversing on the whole—if not in particular branches—the trend of the diminishing returns, the picture is always one of a world where the technical conditions of the productive processes are unceasingly changing.

Taking briefly here the term 'technical progress' for all these movements, we can clearly distinguish two aspects of them, in economic terms. On the one hand, changes in productivity, though operating more or less everywhere, are going on at different rates of change in the various sectors of the economic system, causing thereby a continuous variation of the cost (and of the price) structure. On the other hand, the meaning for the community as a whole of all improvements amounts to a continuous growth of real *per capita* income (we shall abstract here, for simplicity, from the complications connected with possible changes in the distribution of income).

The second of these aspects has been completely neglected by all macroeconomic models and it comes to assume a particular relevance in our analysis. It is, indeed, an inherent characteristic of economic behaviour, already discovered in the last century by E. Engel[1] and recently confirmed and insisted upon by all economists who have dealt with quantitative evaluations of demand, that when real *per capita* income increases the tendency of consumers *is not* to distribute the new income *proportionally* among the commodities previously bought, but, on the contrary, to direct the extra demand towards *new* goods. That is to say, at low real incomes, demand is essentially addressed towards commodities which satisfy the fundamental physiological needs of subsistence (mainly food). As income increases, a part of demand begins to be directed towards other goods (clothes, dwellings, durable goods, &c.) and, as income increases further, towards luxury goods, services of various kinds, and so on.

As a consequence of this behaviour, the relative *composition* of the purchases of consumers varies in time. For the economic system as a whole, the effects are not only that the employment structure changes (relative decrease of employment in agriculture, relative increase in manufacturing,

[1] E. Engel, 'Die Productions- und Consumptionsverhältnisse des König-reichs Sachsen', in *Zeitschrift des Statistischen Bureau des Königlich Sächsischen Ministerium des Inneren*, Nos. 8 and 9, 22 Nov. 1857.

or even more in services, &c.) but also that the *relative composition* of the national product, in real terms, continuously changes; and this as a direct consequence of technical progress.

I have come here to an important point in my line of argument. The non-proportional growth of demand faces entrepreneurs with a big problem, a problem which *would not exist* in the case of a proportional growth of the whole system. The problem consists in finding out those productive branches (always different as income increases) which correspond to the next consumers' preferences in the process of demand expansion caused by an increasing *per capita* income. The problem also entails the adaptation process of consumers to higher possibilities of consumption, and is complicated furthermore by the choice that a growing system is continuously facing, between that part of productivity gains which it prefers devoting to higher production and that part which it prefers devoting to leisure (reduction of the working week). Evidently, in the attempts to find out the solution of this complex problem, the entrepreneurs may make mistakes, and in some periods their fear of being mistaken may be higher than in others, resulting in hesitations and postponements of investment projects. At a macro-economic level, the meaning of these mistakes or simply hesitations comes down to a change in the aggregate behavioural parameters of the system. This has decisive effects on the dynamic movements of effective demand.

It has indeed been an important result of the whole macro-economic analysis to show the dynamic cumulative consequences of certain types of aggregate behaviour. Such an analysis has illustrated that a capitalist system, because of its institutional structure, is bound to move in time according to a mechanism (multiplier-accelerator) which gives rise to different cumulative movements according to the values of the behavioural parameters of the investment function. This theoretical framework, however, has not been able (and is *not* able) to give us any explanation of the values and of the changes in time of such parameters. The arguments which have been developed above now provide such an explanation, which can be used to integrate the previous theoretical framework. They provide, so to speak, the missing link in the theoretical construction.

With this integration, an economic system as a whole emerges not so much with the character of a rigid mechanism, but rather with that of a living organism, which continuously learns from the past experience and continually faces new problems to be solved. The important point is that these problems are always new. To learn how to expand the various branches of the economy at a certain moment is not enough, because in the next period the expansion will have to take a different path. The process of the appearance of these new problems and of the variation of the aggregate

behavioural parameters, with the consequent possibility of fluctuations, is, therefore, a permanent characteristic, inherent in the elements themselves which determine the growth of a modern economic system.

Looked at in this way, cyclical fluctuations and economic growth, far from appearing two opposite or even incompatible phenomena—as indeed they appear from a view which is purely based on post-Keynesian macroeconomic models—emerge as two different aspects or outcomes of the same complex and fundamental process—here comprehensively gathered under the label of 'technical progress'—which incessantly motivates the industrial society in which we live.

MATHEMATICAL APPENDIX

1. In the text of the paper I have tried to avoid too lengthy proofs and long mathematical treatments. The whole mathematics which is behind the stated conclusions is, however, set out in full detail in this Appendix.

2. To begin with, let us prove that the conditions which must be satisfied in order that curves (7)–(8) cross each other exactly coincide with the conditions under which the roots of equation (14) are real numbers.

In order to get the values of the capital–output ratios and of the rates of growth which correspond to the intersection of the two curves of Fig. 1, we have to put $r_k = r_y = r$ in (7)–(8), and solve the system of equations so obtained. The equations become

$$r^2-(\alpha+a-1-\beta)r-(\alpha+a-1)\beta+\alpha\beta = 0,$$

$$\beta v^2-(\alpha+a-1+\beta)v+\alpha = 0,$$

and the solutions are

$$\text{(A 1)} \qquad r_{1,2} = \tfrac{1}{2}(\alpha+a-1-\beta)\pm\tfrac{1}{2}\sqrt{\{(\alpha+a-1-\beta)^2+4(\alpha+a-1)\beta-4\alpha\beta\}}$$

$$= \tfrac{1}{2}(\alpha+a-1-\beta)\pm\tfrac{1}{2}\sqrt{\{(\alpha+a-1+\beta)^2-4\alpha\beta\}};$$

$$\text{(A 2)} \qquad v_{1,2} = \frac{1}{2\beta}(\alpha+a-1+\beta)\mp\frac{1}{2\beta}\sqrt{\{(\alpha+a-1+\beta)^2-4\alpha\beta\}}.$$

It can be seen now that the expression which appears under the square root of both (A 1)–(A 2) coincides with the expression which appears under the square root of (15). This proves the proposition stated at the beginning of this section.

3. Let us now pass to examine the various types of dynamic behaviour which may emerge from equation (12) for the variable Y. The first question to be investigated is whether the roots of the quadratic equation (14) are real or complex. In order that x_1, x_2 may be real, the term which appears under the square root of (15) must not be negative, namely

$$\text{(A 3)} \qquad (\alpha+a+1-\beta)^2 \geqslant 4(\alpha+a-a\beta),$$

which may also be written as

$$\text{(A 4)} \qquad (\alpha+a-1+\beta)^2 \geqslant 4\alpha\beta.$$

The left-hand sides of these inequalities are always positive but the signs of the right-hand sides depend on β. The only thing we can immediately say, therefore, from (A 3) and (A 4) respectively, is that the inequalities are certainly satisfied when $\beta = 0$ and when $\beta \geqslant 1+\alpha/a$. What happens in between these two limits requires further investigation. Taking the derivatives of both sides of (A 3) with respect to

β, we obtain

$$-\frac{d}{d\beta}(\alpha+a+1-\beta)^2 = 2(\alpha+a+1-\beta), \tag{A 5}$$

$$-\frac{d}{d\beta}(4\alpha+4a-4a\beta) = 4a. \tag{A 6}$$

Now, (A 5) is greater than (A 6) when $\beta = 0$ but smaller when $\beta = 1+\alpha/a$. This means that, as β increases, the left-hand side of (A 3) decreases faster than the right-hand side until $\beta = (\alpha+1-a)$, and slower thereafter. In other words, as β increases, the term under the square root of (15) becomes smaller and smaller until a certain point, and then it begins to increase. If it ever becomes negative, in the downward movement, then it necessarily returns to be positive at some later point. To find out whether and where this happens, we must solve the equation

$$(\alpha+a+1-\beta)^2-4(\alpha+a-a\beta) = 0,$$

namely

$$\beta^2-2(\alpha+1-a)\beta+(\alpha+a-1)^2 = 0,$$

or $\beta_{1,2} = (\alpha+1-a)\mp\frac{1}{2}\sqrt{\{4(\alpha+1-a)^2-4(\alpha+a-1)^2\}} = (\alpha+1-a)\mp 2\sqrt{\{\alpha(1-a)\}}$.

Since $a < 1$, then $\sqrt{\{\alpha(1-a)\}}$ is a real number. Hence the term under the square root of (15) does become negative as β increases, and it does so at $\beta = \beta_1$. As β goes on increasing, it returns to be positive when $\beta = \beta_2$.

As a conclusion, the roots of equation (14) are *real numbers* when

$$\beta \leqslant (\alpha+1-a)+2\sqrt{\{\alpha(1-a)\}}$$

and when $\beta \geqslant (\alpha+1-a)-2\sqrt{\{\alpha(1-a)\}}$. For β falling within these two limits, x_1 and x_2 are *complex numbers*.

4. Let us investigate first of all the case in which x_1 and x_2 are real numbers, i.e. the case in which β is either $\leqslant$ than $(\alpha+1-a)-2\sqrt{\{\alpha(1-a)\}}$, or $\geqslant$ than

$$(\alpha+1-a)+2\sqrt{\{\alpha(1-a)\}}.$$

In this case, as can be seen from (13), the dynamic movement of Y_t is fundamentally different according as x_1 and x_2 are positive or negative, smaller or greater than unity. A way of finding this out is to calculate the function

$$f(x) = x^2-(\alpha+a+1-\beta)x+(\alpha+a-a\beta)$$

for critical values of x, namely

$$\begin{aligned} f(\infty) &= +\infty, \\ f(1) &= \beta(1-a), \\ f(0) &= a+\alpha-a\beta, \\ f(-1) &= 2(\alpha+a+1)-\beta(1+a), \\ f(-\infty) &= +\infty, \end{aligned} \tag{A 7}$$

and to bear in mind that

$$x_1+x_2 = (\alpha+a+1-\beta). \tag{A 8}$$

Consider first the interval in which $\beta \leqslant (\alpha+1-a)-2\sqrt{\{\alpha(1-a)\}}$. When exactly $\beta = 0$, all (A 7) are positive except $f(1)$, which is nought. This means that $x = 1$ is, in this case, a root of (14). The other root will be $>$ or $<$ than 1 according as to whether $(\alpha+a)$ is $>$ or $<$ than 1. As a corollary, the inequality

$$(\alpha+a) > 1 \tag{17}$$

turns out to be a very important one; it represents a necessary condition for the system to have the larger root $>$ than 1, i.e. to be at all capable of growth. When $0 < \beta \leqslant (\alpha+1-a)-2\sqrt{\{\alpha(1-a)\}}$, all (A 7) and also (A 8) are positive, which means that both roots are positive. Provided that (17) is satisfied, it can be seen immediately from (A 8) that both x_1 and x_2 are $>$ than 1.

Consider now the second range of values for β, i.e. the interval in which

$$\beta \geqslant (\alpha+1-a)+2\sqrt{\{\alpha(1-a)\}}.$$

When exactly $\beta = (\alpha+1-a)+2\sqrt{\{\alpha(1-a)\}}$, x_1 and x_2 are both equal to $[a-\sqrt{\{\alpha(1-a)\}}]$, which is $<$ than 1. For higher values of β, a further distinction has to be made. If $\alpha < a^2/(1-a)$, there exists an interval in which β is $>$ than $(\alpha+1-a)+2\sqrt{\{\alpha(1-a)\}}$ but $<$ than $(\alpha+a+1)$, the last expression representing the value of β at which $x_1+x_2 = 0$. It appears from (A 7) and (A 8) that within such an interval the roots are both $<$ than 1, either both positive (when $f(0) > 0$), or one positive and one negative but $x_1 > |x_2|$, (when $f(0) < 0$). If $\alpha > a^2/(1-a)$, such an interval does not exist and for

$$(\alpha+a+1) < \beta < \frac{2(\alpha+a+1)}{1+a},$$

it appears again from (A 7) and (A 8) that the real roots are both $<$ than 1 in absolute value, either both negative—when $f(0) > 0$—or one positive and one negative but $x_1 < |x_2|$—when $f(0) < 0$. Finally, when $\beta > 2(\alpha+a+1)/(1+a)$, the ranges for the two roots are $1 > x_1 > 0$ and $x_2 < -1$.

5. As a result of the foregoing analysis, we can now trace the dynamic behaviour of Y_t which emerges from (13) when the roots of (14) are real. Both x_1 and x_2 contribute to the movement in time of Y_t but *eventually* only the larger of the two will dominate, in the sense that it will practically determine by itself alone the dynamic movement of Y_t.

Therefore, supposing for the time being that the arbitrary constants are positive and that (17) is satisfied, when β is in the first of the two ranges of values stated at the beginning of the previous section, i.e. when $\beta \leqslant (\alpha+1-a)-2\sqrt{\{\alpha(1-a)\}}$, the higher root is $>$ than 1, and, therefore, after a few periods, Y_t will grow exponentially at a percentage rate of growth which in time approaches the value

$$\tfrac{1}{2}(\alpha+a-1-\beta)+\tfrac{1}{2}\sqrt{\{(\alpha+a+1-\beta)^2-4(\alpha+a-a\beta)\}}.$$

When β is in the second range of real roots, the movements are more complicated. So long as $(\alpha+1-a)+2\sqrt{\{\alpha(1-a)\}} \leqslant \beta < (\alpha+a+1)$, the higher root in absolute value is positive and $<$ than 1, so that Y_t diminishes in time approaching zero asymptotically. When $(\alpha+a+1) < \beta < 2(\alpha+a+1)/(1+a)$ (i.e. when the larger root is negative and $<$ than 1 in absolute value), Y_t oscillates abruptly from positive to negative values and vice versa from one period to another but the oscillations die out as time goes on. Finally, when $\beta > 2(\alpha+a+1)/(1+a)$ (i.e. when the larger root is negative and $>$ than 1 in absolute value), Y_t oscillates as in the previous case but in an explosive way. The last two cases represent, indeed, very peculiar movements of the system. Fortunately, they do not have any relevant economic meaning, because, in order to come into existence, they would require a very high and unrealistic value for the parameter β. More precisely, if we recall here the interpretation which has been given in section 2 of the paper, these movements would require an investment function such as to make the adaptation of the stock of capital to any variation of income at least twice as fast as the adaptation of consumption to the same variation of income. This is extremely unrealistic.

6. The relation between β and the roots of equation (14) can better be grasped by a graphical representation.[1] Take equation (14) and write it in the following way:

$$\frac{1}{a-x}[x^2-(\alpha+a+1)x+(\alpha+a)] = \beta.$$

By now plotting x on the abscissa and β on the ordinate, we obtain a hyperbola with centre at $[a, (1-a+\alpha)]$ and asymptotes represented by the straight lines $a-x = 0$ and $x+\beta-(1+\alpha) = 0$. Since all our parameters are greater than zero and $a < 1$, it follows that the centre and at least a stretch of each of the two branches of the

[1] The idea has been suggested to me by Professor Carlo Felice Manara.

hyperbola always fall in the positive quadrant. A graphical representation is given in Fig. 3, where the following values have been assumed for the parameters: $a = 0{\cdot}85$, $\alpha = 0{\cdot}75$.

We can now see immediately the relation between x and β. For any predetermined value of β, the roots x_1 and x_2 of (14) correspond (from right to left) to the points at which the straight line parallel to the abscissa, and cutting the ordinate at the predetermined value of β, intersects the hyperbola. (In Fig. 3 one of such straight lines

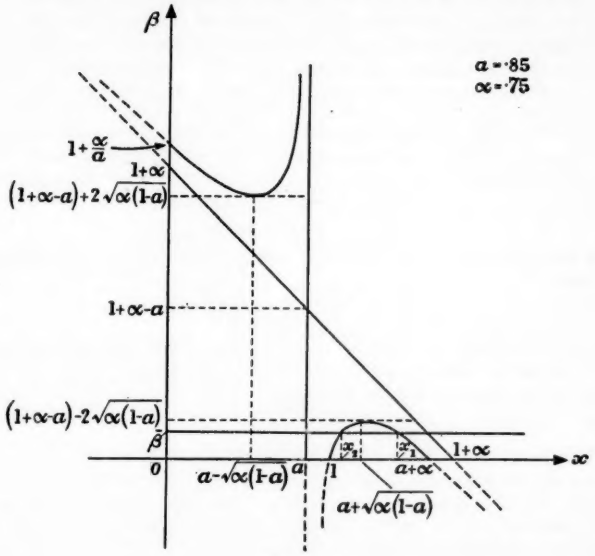

FIG. 3

has been drawn, corresponding to $\beta = \bar{\beta}$.) Such intersections, as can be seen from Fig. 3, take place at two points (two solutions) in the regions where

$$\beta < (\alpha+1-a)-2\sqrt{\{\alpha(1-a)\}}$$

and where $\beta > (\alpha+1-a)+2\sqrt{\{\alpha(1-a)\}}$. They take place at a single point (case in which x_1 and x_2 coincide) at the extremes of the mentioned inequalities, and at no point at all in the region which is within these two extremes. This last region corresponds to the interval (to be examined later) where the roots x_1 and x_2 are complex.

7. After examining the movements of Y_t in the case of real roots, it now becomes easy to derive the corresponding movements of K_t. By substituting (13) into (11) and using (14), we obtain

$$K_t = v_1 A_1 x_1^t + v_2 A_2 x_2^t, \tag{19}$$

where

$$v_1 = \frac{\alpha+a-x_1}{\beta} = \frac{1}{2\beta}(\alpha+a+\beta-1)-\frac{1}{2\beta}\sqrt{\{(\alpha+a+1-\beta)^2-4(\alpha+a-a\beta)\}},$$
$$v_2 = \frac{\alpha+a-x_2}{\beta} = \frac{1}{2\beta}(\alpha+a+\beta-1)+\frac{1}{2\beta}\sqrt{\{(\alpha+a+1-\beta)^2-4(\alpha+a-a\beta)\}}. \tag{A 9}$$

As can be seen, the variable K_t depends exactly on the same initial conditions (A_1 and A_2) and on the same exponential functions (x_1^t and x_2^t) on which Y_t depends. Moreover, it depends on the constants v_1 and v_2. We may now write (A 9) in a more

convenient way, namely

$$\text{(A 10)} \qquad \begin{aligned} v_1 &= \frac{1}{2\beta}(\alpha+a+\beta-1)-\frac{1}{2\beta}\sqrt{\{(\alpha+a+\beta-1)-4\alpha\beta\}}, \\ v_2 &= \frac{1}{2\beta}(\alpha+a+\beta-1)+\frac{1}{2\beta}\sqrt{\{\alpha+a+\beta-1)^2-4\alpha\beta\}}, \end{aligned}$$

where the expressions appearing under the square roots are positive by hypothesis (we are considering the case in which x_1 and x_2 are real). Therefore, when (17) is satisfied, the v_1 and v_2 are *positive*. They correspond exactly to the (A 2).

As a conclusion, when the roots are real, the behaviour of K_t in time is of the same type as the behaviour of Y_t, i.e. it may assume all movements already described in section 5, in correspondence to the already stated intervals for the parameter β.

8. A very interesting economic meaning for the constants v_1 and v_2 emerges from the model by considering the dynamic movement of the ratio of K_t to Y_t. From (13) and (19), we may write

$$\frac{K_t}{Y_t} = \frac{v_1 A_1 x_1^t + v_2 A_2 x_2^t}{A_1 x_1^t + A_2 x_2^t}.$$

Supposing now that $|x_1| > |x_2|$ and dividing both numerator and denominator by x_1, we obtain

$$\frac{K_t}{Y_t} = \frac{v_1 A_1 + v_2 A_2 (x_2/x_1)^t}{A_1 + A_2 (x_2/x_1)^t},$$

where, as $t \to \infty$, $(x_2/x_1)^t \to 0$ and $K_t/Y_t \to v_1$. This means that, as time goes on, the ratio K_t/Y_t tends asymptotically to a well-defined value which—in the case of $|x_1| > |x_2|$—is represented by the constant v_1.

Analogously, when $|x_2| > |x_1|$, $K_t/Y_t \to v_2$.

9. We have not so far examined the signs of the constants A_1 and A_2. In sections 5–8 we have simply supposed that they are positive. The time has now come to look more deeply into this matter. If we assume that capital and income at time zero are given, and if we call them by K_0 and Y_0, we can obtain the values of A_1 and A_2 by putting $t = 0$ in (13) and (19). We have

$$Y_0 = A_1 + A_2,$$
$$K_0 = v_1 A_1 + v_2 A_2,$$

and therefore

$$\text{(21)} \qquad A_1 = \frac{v_2 Y_0 - K_0}{v_2 - v_1},$$

$$\text{(22)} \qquad A_2 = \frac{K_0 - v_1 Y_0}{v_2 - v_1}.$$

The denominators of (21)–(22) are always positive, since $v_2 > v_1$, but the numerators are positive only when, respectively, $K_0/Y_0 < v_2$ and $K_0/Y_0 > v_1$. In any case, only one of the constants A_1, A_2 (the one entering the dominant term) becomes eventually relevant in (13) and (19). From our previous analysis we know that the case which has an economic meaning is the case in which x_1 is the higher root in absolute value, and therefore A_1 becomes the relevant constant. In this case, (21) now shows that A_1 might happen to be negative. Therefore, the dynamic behaviour of Y_t and K_t are as they have been described in section 5 only if the system starts from a situation where $K_0/Y_0 < v_2$. In this case, the ratio K_t/Y_t will tend to v_1 as time goes on. But if the system starts from a position in which $K_0/Y_0 > v_2$, and therefore A_1 does turn out to be negative, a very different behaviour of the system comes into being. Both Y_t and K_t will eventually either explode negatively (if $x_1 > 1$) or converge to zero from the negative side (if $x_1 < 1$), while the capital–output ratio will still tend to a positive value v_1, but with negative numerator and denominator. In these two cases of negative A_1, however, our type of analysis has only a hypothetical relevance, because what matters

practically is no longer how the system will behave eventually but how it behaves in the first few periods (when the larger root is not necessarily dominating). Afterwards, some physical limits will soon put in check the endogenous forces of the system and our equations will lose any interpretative value.

The other case which remains to be considered—i.e. the case in which $|x_2| > |x_1|$ and therefore A_2 becomes the constant of the dominant term—has no relevant economic meaning, as has already been pointed out. In this case, a negative sign for A_2 does not change qualitatively the already-described behaviour of K_t and Y_t (namely violent oscillations from negative to positive values and vice versa). The capital–output ratio still tends towards a positive value (v_2 this time) but with numerator and denominator both oscillating in sign from period to period.

10. We come at last to tackle the case in which x_1 and x_2 are complex numbers. In this case, expression (13) comes to be composed by real parts and by imaginary parts, so that it is not suitable for a quick investigation. Fortunately, when x_1 and x_2 are *complex*, they also have the property of being *conjugate*, as can be seen from (15). This enables us to use a well-known device for transforming (13). In this case, by hypothesis,

$$(\alpha+a+1-\beta)^2-4(\alpha+a-a\beta) < 0.$$

We can use the notations:

$$d = \tfrac{1}{2}(\alpha+a+1-\beta),$$

$$g = \tfrac{1}{2}\sqrt{\{-[(\alpha+a+1-\beta)^2-4(\alpha+a-a\beta)]\}},$$

$$i = \sqrt{(-1)},$$

and write (13) as

$$Y_t = A_1(d+ig)^t+A_2(d-ig)^t.$$

This expression may be written in terms of trigonometric functions, namely[1]

$$Y_t = B\rho^t\cos(t\theta+\epsilon), \tag{16}$$

where the arbitrary constants (to be determined, in our problem, by initial conditions) are now B and $\cos\epsilon$. The other terms are related to the original parameters of our system by the following definitions:

$$\rho = \sqrt{(\alpha+a-a\beta)}, \tag{A 11}$$

$$\cos\theta = \frac{\alpha+a+1-\beta}{2\sqrt{(\alpha+a-a\beta)}}. \tag{A 12}$$

11. Expression (16) is equivalent to (13) and has the advantage, when x_1 and x_2 are complex, of being entirely expressed in real terms. It is now easy to infer from it the dynamic behaviour of Y_t in the case of complex roots. As t increases, the cos term in (16) brings about regular cycles of a constant length, approximately equal to $360°/\theta$ periods of time. The amplitude and the phase of the first cycle are determined by the constants B and $\cos\epsilon$. Then, whether the amplitude of successive cycles will become greater or smaller depends on the *modulus* ρ. If $\rho > 1$, the amplitude will increase (explosive cycles); if, on the other hand, $\rho < 1$, the amplitude will decrease (damped cycles).

In our problem—as we have seen—the range within which the roots are complex is

$$(\alpha+1-a)-2\sqrt{\{\alpha(1-a)\}} < \beta < (\alpha+1-a)+2\sqrt{\{\alpha(1-a)\}}.$$

By substituting these two extremes into (A 11), it can be seen that, for β equal to the first extreme, ρ is more than 1, provided that (17) is satisfied, and for β equal to the second extreme, ρ is $<$ than 1 (except for exceptional values of α, of the order of 100 for $a = 0{\cdot}85$, in which case ρ remains $>$ than 1). Normally, therefore, there is a value of

[1] See, for example, R. G. D. Allen, op. cit., chap. 6.

β within the range of complex roots [and this value is $\beta = (\alpha+a-1)/a$], which divides the range of explosive from the range of damped fluctuations.

12. The expression representing the movement of K_t in the case of complex roots is similar to the one representing the movement of Y_t. Substituting from (16), equation (19) becomes:

$$K_t = \frac{B}{\beta}\rho^t[(\alpha+a)\cos(t\theta+\epsilon)-\sqrt{(\alpha+a-a\beta)}\cos(t\theta+\epsilon+\theta)],$$

which may usefully be written in a simpler way after a few transformations:

$$K_t = \frac{B}{\beta}\rho^t\{(\alpha+a)\cos(t\theta+\epsilon)-\sqrt{(\alpha+a-a\beta)}[\cos(t\theta+\epsilon)\cos\theta-$$

(A 13)
$$-\sin(t\theta+\epsilon)\sin\theta\},$$

$$K_t = \frac{B}{\beta}\rho^t\{[\alpha+a-\sqrt{(\alpha+a-a\beta)}\cos\theta]\cos(t\theta+\epsilon)+$$

$$+\sqrt{(\alpha+a-a\beta)}\sin\theta\sin(t\theta+\epsilon)\}.$$

Putting now:
$$\alpha+a-\sqrt{(\alpha+a-a\beta)}\cos\theta = \zeta\cos\eta,$$
$$\sqrt{(\alpha+a-a\beta)}\sin\theta = \zeta\sin\eta,$$

where:
$$\zeta^2 = [\alpha+a-\sqrt{(\alpha+a-a\beta)}\cos\theta]^2+(\alpha+a-a\beta)\sin^2\theta,$$
$$\operatorname{tg}\eta = \frac{\sqrt{(\alpha+a-a\beta)}\sin\theta}{\alpha+a-\sqrt{(\alpha+a-a\beta)}\cos\theta},$$

and substituting into (A 13), we come to the expression

$$K_t = \frac{B}{\beta}\rho^t[\zeta\cos\eta\cos(t\theta+\epsilon)+\zeta\sin\eta\sin(t\theta+\epsilon)],$$

which, by an elementary property of trigonometric functions, may finally be written

(20)
$$K_t = \frac{B}{\beta}\zeta\rho^t\cos(t\theta+\epsilon-\eta).$$

The relation between the fluctuations of capital and the fluctuations of income can now be directly inferred by a comparison of (20) with (16). The cycle of K_t is related to the cycle of Y_t by a fixed proportion ($\gamma = \zeta/\beta$), it has exactly the same length ($360/\theta$ periods of time) and the same behaviour over time (determined by ρ), but a different phase, in the sense that it lags behind it by a fraction η/θ of a period of time. The same constants B and $\cos\epsilon$ determine the amplitude and the phase of the first fluctuation.

13. We shall finally have a look again at the case in which the system produces a steady growth, in order to find out the factors which determine the proportional rate of change. The topic is relevant for the discussion which is carried out in section 7 of the paper.

We have already shown that a steady (exponential) growth takes place when $0 \leqslant \beta \leqslant (\alpha+1-a)-2\sqrt{\{\alpha(1-a)\}}$. We may notice now that the second extreme of this interval can never be negative, since

$$\alpha+(1-a)-2\sqrt{\{\alpha(1-a)\}} = [\alpha-(1-a)]^2 \geqslant 0.$$

It follows that there normally exists a whole family of positive β which leads to a steady growth.

For any given β belonging to this family, the rate of growth of the system depends on the value of α relatively to the value of a, as can be seen immediately from the expression we have found (in section 5 of this Appendix) for the proportional rate of growth of the system (which we may call R), namely from

(A 14)
$$R = \tfrac{1}{2}[\alpha-(1-a)-\beta]+\tfrac{1}{2}\sqrt{\{(\alpha+a+1-\beta)^2-4(\alpha+a-a\beta)\}}.$$

The simplest way of considering (A 14) is to begin by supposing that β takes the maximum value allowed by the exponential growth range. In such a case, the expression which appears under the square root of (A 14) vanishes, and the proportional rate of growth of the system becomes:

$$R = \tfrac{1}{2}[\alpha-(1-a)-\beta]. \tag{A 15}$$

Now we can see from (A 15) that for any predetermined a and β, R may assume any large or small value as we like depending entirely on the value of α. The same proposition remains valid (with the difference that higher values of R will correspond to the same values of α) for any value of β which is lower than the maximum.

Nuffield College, Oxford

OXFORD ECONOMIC PAPERS

Volume 12. February 1960. Number 1

CONTENTS

Economic Theory and Agrarian Economics. By N. GEORGESCU-ROEGEN 1

Aggregated Rebate Schemes and Independent Competition. By B. YAMEY 41

Notes on the Working of the Gold Standard before 1914. By A. G. FORD 52

Earnings-Drift in the United Kingdom, 1948–57. By J. MARQUAND 77

Cash-Flow in a Controlled Economy: the Case of Hungary. By JANOS BARACS 105

A Note on the Measurement of Real Income. By STANISLAW WELLISZ 112

AMERICAN ECONOMIC REVIEW

CONTENTS

VOLUME L JUNE 1960 Number 3

ARTICLES:

AN INDEX OF SOVIET INDUSTRIAL OUTPUT — N. M. Kaplan and R. H. Moorsteen
RETURNS EQUALIZATION AND REGIONAL GROWTH — G. H. Borts
MONETARY RESERVES AND CREDIT CONTROL — J. M. Henderson
THE 'OUTER SEVEN' AND EUROPEAN INTEGRATION — M. E. Kreinin
WESTERN DEVELOPMENT OF THE RHODESIAS — Stephen Enke
A MODEL OF PRICE FLEXIBILITY — J. V. Yance
THE ALLOCATION OF JOINT COSTS — A. A. Walters

COMMUNICATIONS:

FOREIGN LANGUAGE BOOKS IN ECONOMICS — R. S. Howey
A REGIONAL COUNTERMEASURE TO NATIONAL WAGE STANDARDIZATION — J. M. Buchanan and J. E. Moes
POPULATION AND ECONOMIC GROWTH: Comment, H. H. Villard; Reply, E. E. Hagen.
THE SHAPE OF THE INCOME DISTRIBUTION: Comment, F. G. Adams; Reply, Stanley Lebergott.

The AMERICAN ECONOMIC REVIEW, a quarterly, is the official publication of the American Economic Association and is sent to all members. The annual dues are six dollars. Address editorial communications to Dr. Bernard F. Haley, Editor, AMERICAN ECONOMIC REVIEW, Stanford University, Stanford, California. For information concerning other publications and activities of the Association, communicate with the Secretary-Treasurer, Dr. James Washington Bell, American Economic Association, Northwestern University, Evanston, Illinois. Send for information booklet.

INTERNATIONAL ECONOMIC REVIEW

Published by the Kansai Economic Federation with the collaboration of the Wharton School of Finance and Commerce, University of Pennsylvania, and the Institute of Social and Economic Research, Osaka University.

Chief editor: L. R. KLEIN
(*University of Pennsylvania*)

Co-editor: M. MORISHIMA
(*Osaka University*)

VOLUME I MAY 1960 NUMBER 2

Editorial Note

The Pareto-Lévy Law and the Distribution of Income *Benoit Mandelbrot*

On Equilibrium Growth of Capital and Labor *Yoichi Shinkai*

A Theory of Interstate Differences in the Rates of Growth of Manufacturing Employment in a Free Market Area *Jerome L. Stein*

Balanced Growth of Firms in a Competitive Situation with External Economies *Michio Morishima* and *Gerald L. Thompson*

The Keynesian Theory of Inflation: The Two Faces of Janus? *Sidney Weintraub*

The Review is published fully in English, three times a year. The annual subscription price is $4.00 per year outside Japan and ¥1,200 per year in Japan; the price of a single copy is $1.50 outside Japan, ¥500 in Japan. Subscriptions outside of Japan should be forwarded to THE INTERNATIONAL ECONOMIC REVIEW, Wharton School of Finance and Commerce, University of Pennsylvania, Philadelphia 4, Pa., U.S.A. Subscriptions in Japan should be forwarded to THE INTERNATIONAL ECONOMIC REVIEW, Kansai Economic Federation, Osaka Building, Soze-cho, Kita-ku, Osaka, Japan.

Manuscripts for publication should be sent to the chief editor or co-editor of the Review.

PRINTED IN GREAT BRITAIN AT THE UNIVERSITY PRESS, OXFORD
BY VIVIAN RIDLER, PRINTER TO THE UNIVERSITY